IUCN The World Conservation Union SSC Species Survival Commission

ANTELOPE SPECIALIST GROUP

GNUSLETTER

Volume 31 Number 1 May 2013

In this Issue...

From the ASG Chairs ...

Membership - Next Quadrennium

ASG 2013-2016. As most readers of Gnusletter will know, IUCN operates in 4-year terms beginning after each World Conservation Congress. The new quadrennium has recently begun, bringing with it some changes to the group's remit, which has traditionally covered a few non-antelope species for pragmatic reasons. Plans to establish a separate Giraffe and Okapi Specialist Group are at an advanced stage so responsibility for these two taxa will soon transfer to the new group and we wish them every success. However, as we say goodbye to the giraffids, we also welcome the wild camel: until now this has been the only mammal species not covered by one of the SSC specialist groups. Following a request from the SSC Chair, ASG has agreed to include wild camel within its remit, where it now joins the African buffalo, pronghorn, and water chevrotain as an 'honorary antelope'.

A high priority for this quadrennium will be to reassess the IUCN Red List status of all antelopes – a full reassessment of all mammals is due by the end of 2015. As this process develops we will be seeking information on current distribution, status, numbers and population trend of all antelope species. We are also looking for potential members of the ASG Red List Authority who can participate in the reassessment exercise and are willing to undertake the online RL training course: in the first instance contact David Mallon, ASG Red List Coordinator (d.mallon@zoo.co.uk).

Taxonomy is another issue that will feature prominently over the next four years. There is an ongoing debate within many IUCN specialist groups over the splitting of species and the use of the Phylogenetic Species Principle. ASG's current position on antelope taxonomy was set out in Gnusletter 29(2) and is under constant review, as DNA techniques become more sophisticated and are more widely applied. Research can bring complete clarity, such as the recent DNA study demonstrating that the type material of the enigmatic *G. arabica* was in fact from *G. gazella* (see page 22). In other cases the picture becomes more complex. Take, for example, the lesser kudu: clear differences in cranial measurements between three populations, plus variations in coat colour, have been described, but current research reported in the latest European Lesser Kudu studbook (Steck 2012) indicates no genetic differences in animals from different parts of the range: more on this study in a later issue of Gnusletter.

Dr Vivian J. Wilson 1932-2012

Viv Wilson, one of Africa's great self-taught field zoologists, died in September. To all of those who knew him, "Viv" was one of those rare home taught naturalists who knew a little about everything and a lot about many other things. Without doubt, nobody knew more about Duiker than Viv.

He was someone you went to when you wanted an informed opinion on antelope or mammal issues.

He was born in Durban and on leaving school first worked as a laboratory technician for years before fulfilling an ambition and in 1954 becoming a game ranger in Umfolozi Game Reserve in Zululand and shortly thereafter joined the Department of Game & Tsetse in Northern Rhodesia, now Zambia where he was posted to the Luangwa valley. It was here that he started his work on the common duiker for which he was recognised with an M.I.Biol. Always a keen herpetologist he collected black mambas for their venom to make serum and lost a finger to a puffadder bite.

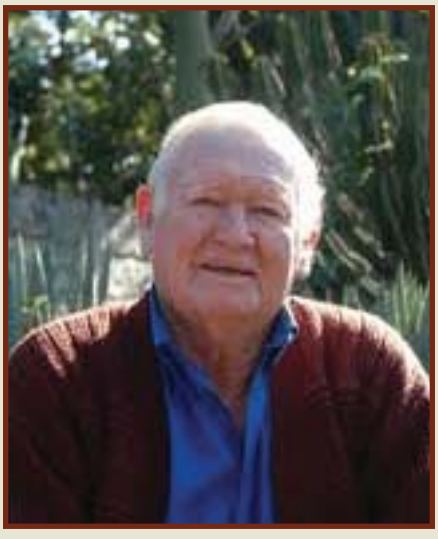
In 1964, he moved to the Rhodesian Dept. of National Parks & Wildlife Management and was tasked with collecting as much information as possible from the renewed game eradication programme in the "corridors" created to halt the spread of Tsetse fly. In 1967 he transferred to the Natural History Museum at its zoologist and in 1972 was promoted to its Director. With his wife Paddy, he formed the Chipangali Wildlife Orphanage in 1973. In 1975, he then left the Museum to run Chipangali full time and to continue with his privately funded research projects.

He was a former chairman of Zimbabwe Parks and Wildlife Board and was a member of the IUCN's Antelope Specialist Group.

Recognition of Viv's work came with the awarding of the United Nations Environmental Award and in 1987, the Rolex Enterprise Award in 1987 and the Zimbabwe Meritorious Medal. He also was awarded an honorary PhD.

Viv authored over 100 scientific papers and wrote two popular books and was a key person in a series of documentary TV programmes. He will be always be remembered in the annals of antelope conservation for his 800 page tome "Duikers of Africa: Masters of the African forest floor", the result of 12 years of research over the range of Africa's duiker species.

- by Jeremy Anderson



The ASG Co-Chairs participated to some of the latest most important events related to wildlife conservation:

The last IUCN World Conservation Congress was held from 6 to 15 September 2012 in Jeju, Republic of Korea.

The IUCN World Conservation Congress is the world's largest and most important conservation event. Held every four years, it aims to improve how we manage our natural environment for human, social and economic development. Leaders from Government, the public sector, non-governmental organizations, business, UN agencies and social organizations joined together to discuss, debate and decide solutions for the world's most pressing environment and development issues. The Congress had two main components: (i) the Forum is a hub of public debate bringing together people from all walks of life to discuss the world's most pressing conservation issues; (ii) the Members' Assembly is IUCN's highest decision-making body, a unique global environmental parliament involving Governments and NGOs taking joint decisions.

Among the very numerous events held at the Congress, two were of particular interest to the Antelope Specialists Group Members:

- **The SSC Members meeting, 6 September 2013:**

As Chair of the Species Survival Commission (SSC), Simon Stuart presented the activities of the SSC during the past four years. The SSC hosts 8050 members (including the ASG members of course) from 173 countries. The Specialist Groups Chairs were given the opportunity to talk about their respective Specialists Groups and Co-Chair Philippe Chardonnet presented a communication on ASG: activities in the last quadrennium, concerns, success stories, challenges and future goals. Mark Stanley-Price added important comments and proposed creation of an antelope fund for improving the in situ conservation of antelopes.

- **The Knowledge Café organised by ASG, 11 September 2013:**

The proposal of a Knowledge Café (KC) had been submitted by ASG to IUCN and was accepted under the title: "Enhancing the resilience of antelopes to human threats: from plan to action" (see former Gnusletter issue). The KC was facilitated by Co-Chair Philippe Chardonnet and ASG Member Jens-Ove Heckel.

As a follow up of the KC organized by ASG at the preceding World Conservation Congress in Barcelona four years ago, this KC addressed the need for boosting action in antelope conservation by identifying (i) the constraints to transform recommendations into actions & (ii) the actions needed to make effective progress in the field. With a limited duration of two hours, the KC was not expected to solve the difficult equation of the resilience of antelopes. However, it was felt necessary to explore the drivers of the variations in resilience among antelopes with 26% of them being threatened (with one third of them declining) and the others not threatened, given that the overall trend of the conservation status of the antelopes is not improving. The debate started by investigating the resilience and ended by forecasting possible action. A few selected comments are reported here.

Souleymane Konaté, Cote d'Ivoire, discussed legal and illegal harvests and raised the ideas of expanding game farming into regions of Africa where it does not occur yet and of developing the game farming technology.

Jens-Ove Heckel explained the situation in the Horn of Africa where antelopes are in jeopardy despite absence of hunting. He discussed the differences between more resilient antelopes, e.g. dik dik and dibatag, and less resilient ones, e.g. hartebeests and gerenuk. He raised the importance of better knowing the specific needs of each taxon and of matching these needs.

Philippe Chardonnet discussed the high resilience of common species, e.g. bushbuck and common duiker in savanna and blue duiker in forest. He suggested developing research in such taxa rather than spending all the efforts on more charismatic taxa.

Angus Middleton, Zimbabwe, discussed the first right for local people: antelopes can be saved if local people find their own tangible interest in their conservation. He also discussed the need for law and order in range countries and assumed that in countries with civil unrest, local people are the only guarantee of conservation if they have a perception of ownership.

The balance was then debated between coercive/repressive approaches (law enforcement) and incentive approaches (nature-based income generating activities).

Souleymane Konaté deplored the little general interest in antelopes and the small number of antelope experts. He recommended expanding the number of ASG Members.

It was proposed to develop a toolbox of antelope conservation methods based on success stories in conservation and positive results in applied research.

Philippe Chardonnet recalled the proposal by Mark Staneley-Price to create a so-called "global alliance for antelope conservation" for raising funds and responding to the pressing need for action in preserving antelopes in general.

The sixteenth meeting of the Conference of the Parties (CoP16) of the Convention on International Trade in Endangered Species (CITES) was held in Bangkok, Thailand, between 3 and 14 March 2013.

It was the 40th Anniversary of the CITES since its creation in 1973 in Washington, DC. And the second time the CoP was held in Bangkok, 9 years later. 178 Parties with 3 new ones: Bahrain, Maldives and Lebanon. More than 2000 delegates attended. ASG Co-Chair Philippe Chardonnet participated to the meeting. Two antelope species were addressed by the official agenda.

- **Tibetan antelope**

"The [CITES] Secretariat introduced document CoP16 Doc. 55, which had been prepared by the Standing Committee and included a recommendation to amend Resolution Conf. 11.8 (Rev. CoP13). However, it informed the Committee that several significant seizures had taken place in 2013 and that, as a result, it had withdrawn its recommendation, noting that the issue would be reconsidered at SC64 and SC65.

China provided further details of the seizures, noting that a follow-up investigation was taking place with assistance from Nepal. It highlighted the need for urgent action from the international community, and called for Parties to investigate any illegal activity involving the species. It proposed two draft decisions for consideration by the Committee:

Directed to the Parties:
All Parties should immediately bring every seizure of illegal Tibetan antelope wool and its products made within its territory to the attention of authorities in countries of origin, transit and destination, as applicable, and to the attention of the Secretariat. Information on the seizure should be accompanied by available associated information, to enable follow-up investigations to take place. The progress of follow-up investigations should be reported to the Secretariat.
Directed to the Secretariat:
The Secretariat shall report information on seizures made and on the progress of investigations referred to in decision 16.AA, at the 65th meeting of the Standing Committee.

India gave details of alternative livelihoods now available to artisanal weavers formerly dependant on shahtoosh and expressed the opinion that elimination of demand was the best method of controlling trade in Tibetan Antelope products. The draft decisions proposed by China were accepted."
(Source: CoP16 Com. II Rec. 11 – p. 2 & 3)

- **Saiga antelope**

"The [CITES] Secretariat introduced document CoP16 Doc. 56, which described progress in implementation of Decisions 14.91, 14.93 (Rev. CoP15), 14.95 (Rev. CoP15), 14.96 and 14.97 (Rev. CoP15) regarding the saiga antelope. The Annex to the document contained a series of draft decisions proposed as replacements for the existing Decisions.

In response to a query from Japan, the Secretariat stated that the online saiga database of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) would be launched soon, and it indicated that the information required for the database was set out under the nine activities specified in the Medium Term International Work Programme for the Saiga Antelope (2011-2015). The CMS Secretariat confirmed that the database would be launched at a technical meeting in June 2013 and would serve as a tool to monitor progress in implementation of work under the Memorandum of Understanding concerning Conservation, Restoration and Sustainable Use of the Saiga Antelope (*Saiga tatarica tatarica*).

China supported the adoption of the draft decisions and asked for clarification on the use of the word "trade", as this could have a different meaning in CITES from that in CMS, and regulation of domestic trade could be budersome.

The United States of America and Ireland, speaking on behalf of the Memebr States of the European Union and Croatia, also supported adoption of the draft decisions. They expressed the hope that range States would meet their reporting obligations so that the proposed decisions would be implemented more effectively than the existing ones.

The Russian Federation believed that, in order for conservation activities to be effective, the saiga should be transferred to Appendix I. It intended to submit a proposal to that effect at CoP17. China raised concerns about such a transfer, and considered that current conservation activities would be sufficient to stabilize the population.

The Committee agreed to repeal Decisions 14.91, 14.93 (Rev. CoP15), 14.95 (Rev. CoP15), 14.96 and 14.97 (Rev. CoP15) and accepted the draft decisions in the Annex to document CoP16 Doc. 56."
(Source: CoP16 Com. I Rec. 2 - p. 1)

The thirteen annual meeting of the Sahelo-Saharan Interest Group (SSIG) was held in Agadir, Morocco, on 2-3 May 2013. The meeting was attended by many ASG Members (including both ASG Co-Chairs) who presented communications:

F. Cuzin - The new distribution atlas of mammals from a Moroccan/Saharan Perspective.

A. Fellous – Update on gazelles conservation in Algeria.

J.-O.Heckel – Update on the work of the North-east African subgroup of the IUCN/Antelope SG and on the work of the EAZA Antelope TAG.

D. Mallon – State of the art on antelope conservation projects in the Sahara & the Sahel.

J. Newby - Update on SCF and projects.

M. Stanley-Price -State of the Art on reintroduction project in arid lands.

T. Woodfine. - Measuring grazing pressure as part of post-release monitoring of reintroduced antelope in semi-arid steppe.

Announcement and call for papers
Gnusletter is planning to produce a special issue on the African Buffalo *(Syncerus caffer*).
Papers are welcome on any topic related to the African Buffalo: conservation status, conservation projects, scientific research, and news. Please send contributions to the editor and to Philippe Chardonnet (p.chardonnet@fondation-igf.fr)
- *Phillipe Chardnonnet*

RECENT MEETING REPORTS

Conservation workshop on conserving Djibouti's priority land animals
The workshop took place in Djibouti, 25-29 March 2012. The main goals of the workshop were to develop conservation plans for priority species of Djibouti and to generate increased awareness of the need for biodiversity conservation in Djibouti in general. The workshop was a partnership between the government of Djibouti, IUCN specialist groups (including ASG), the IUCN Eastern and Southern Africa Regional Office (ESARO), Association DECAN, The World Pheasant Association, and Association Beauval pour Conservation et Recherche. Priority faunal groups considered were carnivores, birds and ungulates – including seven antelopes: beira, Soemmering's and Pelzeln's gazelles, beisa oryx, gerenuk, Salt's dik-dik, and klipspringer. The workshop was preceded by a one-day seminar to provide an overview of conservation issues in Djibouti and the Horn of Africa in general, and the conservation status of, and threats to, Djibouti's terrestrial fauna. The workshop had a high profile locally and attracted welcome interest from the government - five ministers attended the opening. The workshop report will be available soon.

Protected Areas Resistant to Climate Change (PARCC)
This GEF-funded project organised a workshop in Lome, Togo, 24-27 July 2012 to conduct a climate change vulnerability assessment for all West African mammals, including antelopes. ASG also participated. The final report will be available soon (details in next issue).

Western Derby Eland
A workshop to develop a conservation strategy for the Western Derby Eland was held in Saly, Senegal, 29-31 January 2013. The main organisers were the Derbianus Czech Society for African Wildlife, in cooperation with Directorate of National Parks in Senegal and Society for the Protection of the Environment and Fauna in Senegal. More than 40 participants from 7 countries attended. The workshop was officially opened by the Czech ambassador and the Director of the Ministry of Environment of Senegal. A detailed status review prepared for the meeting was updated and revised, and a threat analysis was carried out, before a set of objectives was formulated. The future of this antelope is tied to that of Niokolo National Park (930,000 ha) in southeastern Senegal, where the last wild population of the western subspecies survives. A field trip to NKNP preceded the workshop. No Derby elands were sighted, though bushbuck, waterbuck, Buffon's kob, roan, western hartebeest, Oribi and red-flanked duiker were seen - all in small numbers. Shorter workshop visits were made to observe semi-managed Derby elands in the privately-owned Bandia and Fathala reserves. The workshop report is in preparation.

Sable Antelope Conservation Stakeholders' Workshop
In recognition of the threats facing Sable antelopes in Kenya, the Kenya Wildlife Service under the World Bank funded project-KCDP, and in collaboration with other stakeholders initiated development of a national Sable antelope management and conservation strategy, to guide conservation efforts towards attaining a viable Sable antelope population in the country. Two taskforce meetings have been held and a draft conservation and management strategy was developed. A stakeholders' meeting to discuss the draft document was held on 15 November 2012 at Diani Forest Lodge, Ukunda.

Technical Workshop on the Reintroduction of Scimitar-horned Oryx to the Ouadi Rimé- Ouadi Achim Game Reserve, Chad
2-4 May 2012

EXECUTIVE SUMMARY
On May 2nd, 2012, 32 delegates from 16 international organisations and government agencies gathered at the Novotel Hotel "La Tchadienne" in N'Djamena, Chad, for a three-day workshop focused on the reintroduction of scimitar-horned oryx to the Ouadi Rimé-Ouadi Achim Game Reserve in central Chad. The principal sponsors of the initiative were: the Sahara Conservation Fund (SCF), the Mohamed bin Zayed Species Conservation Fund, the Convention on Migratory Species (CMS), St Louis Zoo, the Addax and Oryx Foundation, and Al Ain Zoo. The workshop was opened by the Minister of Environment and Water Resources, His Excellency Mahamat Bechir Okormi, and was facilitated by the IUCN SSC Conservation Breeding Specialist Group.
The goals of the initiative were:
• To raise awareness and support amongst key Chadian stakeholders for the international project to reintroduce the scimitar-horned oryx in Chad;
• To assess the Ouadi Rimé-Ouadi Achim Game Reserve (ORO-AGR) as a priority site for oryx restoration, using information collected in the field and from workshop participants, and using criteria jointly defined previously;
• To gain a common understanding of what is needed in order to restore oryx to Chad;

• To explore and take advantage of opportunities for this project, in order to deliver broader impact on the conservation of biodiversity in Chad, and in particular those opportunities prioritised in the National Biodiversity Conservation Strategy.

Participants worked collaboratively to build a vision for the return of oryx to Chad, in order to identify the challenges involved and to define broad directions for future action. Significant outputs of the workshop are described below.

THE VISION
The following long-term vision for the return of oryx to Chad was developed and approved by workshop participants:

POPULATIONS OF SCIMITAR-HORNED ORYX, A CULTURAL SYMBOL, ARE VIABLE AND FREE TO ROAM THROUGHOUT THEIR ANCESTRAL RANGE, IN RESTORED AND PRODUCTIVE ECOSYSTEMS THAT MEET THE NEEDS OF BOTH WILDLIFE AND LOCAL COMMUNITIES. IN THIS WAY, THE PROTECTION OF THE SCIMITAR HORNED ORYX AND ITS HABITAT CONTRIBUTES TO THE SOCIO-ECONOMIC AND CULTURAL DEVELOPMENT OF THE LOCAL PEOPLE LIVING IN HARMONY IN THE OUADI RIMÉ – OUADI ACHIM GAME RESERVE. THE RESERVE INCREASES NATIONAL CAPACITY AND EXPERTISE AND IS A RECOGNIZED MODEL OF SUSTAINABLE DEVELOPMENT AND CONSERVATION IN THE SAHEL-SAHARA ZONE.

From the GNUSLETTER Editor...

Antelope Specialist Group (ASG) and the Association of Zoos and Aquariums (AZA)

Antelope programs in zoos play a key role in conservation, repre senting the incredible diversity of the natural world for education programs, and as reservoir populations for antelope reintroductions or as a hedge against the extinction of wild populations. Zoo antelope programs are instrumental in raising significant financial and technical support for antelope conservation projects worldwide and are credited with saving species such as the scimitar-horned oryx, the Arabian oryx and the Mhorr gazelle.

To showcase the historic collaboration between the AZA Antelope Taxon Advisory Group and the ASG, a meeting session was dedicated to illustrate and strengthen the links between zoo antelope programs and antelope conservation. ASG members Mallon, Newby, Wacher and Shurter presented their perspectives on collaborative antelope projects with which they are involved. An evening reception was held to provide a forum for zoo partners to meet and discuss antelope projects with the presenters. The session was well attended as well as the evening reception event.
Special thanks go out to Bill Houston and Martha Fischer of the Saint Louis Zoo for organizing and funding the session and the event. The session would not have been possible without the gracious support of sponsors including the Saint Louis Zoo, San Diego Zoo Global, Disney's Animal Kingdom, White Oak Conservation Center and Adam Eyres.

Program Session Abstract:
Antelopes are popular in zoos, widely displayed in collections as key representatives of African themed exhibits. The conservation need of antelopes as key pieces in Asian and African ecosystems is less well known yet the relevance for zoo participation is crucial. We describe historic zoo efforts engaged in antelope conservation practices, including a review of the reintroductions of the Arabian oryx to native habitat on the Arabian Peninsula. The status of antelopes of the world are prioritized for conservation through the role of the IUCN Antelope Specialist Group, developing strategies and setting priorities to promote conservation efforts, including zoo partners. The Antelope TAG and Antelope Specialist Group provide forums and publications to educate zoo partners and engage them in both conservation breeding, research and field conservation efforts. Antelope are flagships for the creation of protected areas and zoo antelope programs provide animals for reintroductions and technical and financial support for field conservation initiatives. International collaboration between zoos, specialist groups, NGO's and range states is critical to antelope survival.

Title: ***The Current Status of Antelopes – A Global Review***
Presenter: David Mallon, Manchester Metropolitan University, UK, IUCN Antelope Specialist Group Co Chair
Ninety two species of antelopes are recognized and assessed on the IUCN Red List occurring across Africa and in Europe, the Middle East and Asia. The status of most antelopes is deteriorating worldwide, with reduced ranges and local extinctions leading to unquantified losses of intraspecific genetic diversity. The consequence is a shrinking number of dynamic, fully functioning ecosystems at wild landscape scales, with concomitant gradual and apparently inevitable shift in the concept of wild antelopes.

Title: ***Rise of the Phoenix: Restoring the Scimitar-horned Oryx to Chad***
Presenter: John Newby, CEO, Sahara Conservation Fund
The scimitar-horned oryx became extinct in the wild in 1992 probably in Central Chad. The oryx and other wildlife became part of the collateral damage brought about by Chad's civil war. The Sahara Conservation Fund's efforts are underway to restore the oryx back into the wild in Chad. We highlight the opportunities and challenges that the species' restoration represents, and how zoos can contribute to one of the most exciting and important conservation initiatives of our times.

Title: *What is wild? A Progress Report on 30 Years of Antelope Reintroductions*
Speaker: Tim Wacher, Senior Conservation Biologist, Zoological Society of London
This presentation reviews historic zoo antelope reintroductions from zoo and managed populations including progress to date. Criteria for reintroduced antelope population "success" will be discussed, in light of the historic and ongoing challenges to "wild" antelope populations in Africa and the Middle East and the need for their long term management. The continued commitment, participation and support from zoos serves as a critical catalyst, building much needed capacity for project success.

Title: ***Topi or not Topi? Your Vote for the Sexiest Antelope Alive!***
Presenter: Steve Shurter, Director of Conservation, White Oak Conservation Center, Editor Antelope Specialist Group GNUSLETTER
Antelopes represent diversity and habitats with key antelope conservation projects developed, to establish protected areas, for

reintroductions, and capacity building. Zoos struggle to maintain antelope collections due to low public appreciation, resulting in decreasing antelope program sustainability. The Antelope TAG and IUCN Antelope Specialist Group employ strategic media techniques and orchestrate connections between zoos and field programs, prioritizing field projects and conservation activities, insuring antelope conservation relevance and sharing information while building antelope constituency.

Recent Reports

Body Condition Score evaluation for Arabian Oryx

Husam El Alqamy, alqamy@gmail.com
Biodiversity management Sector, Environment Agency – Abu Dhabi.

Reintroduction projects involve close monitoring efforts to assess the survival and establishment of the reintroduced species. In case of antelope reintroductions this task becomes relatively harder due to the vast ranges covered by the animals the relative difficulty of approaching the animals to distance enabling visual assessment.
A scheme for body condition scoring is adopted as an approach to provide measurable, quantitative and informative indicator of the fitness of the Arabian oryx herd in AOPA. The scheme is modified after (Gilbert and Woodfine, 2003) using the dairy cattle body condition scoring developed by University of California (Davis) veterinary medicine extension. The system is based on visual assessment of the back posture of the animal and defining the body condition score according to presence or absence of some features and like musculature, fat deposition, spinal vertebrae and caudal vertebrae. The system adopted after Gilbert and Woodfine have a scale of 6 integer scoring grades where the animals are evaluated using the visual appearance of the spine, musculature and fat deposition (see figure1). However, it is probably general and have some bias for observer effect especially when used to assess reintroduced animals by different staff members. Personal variations among different observers is expected to significantly affect the final result.

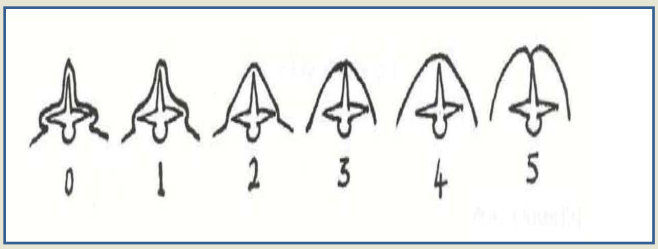
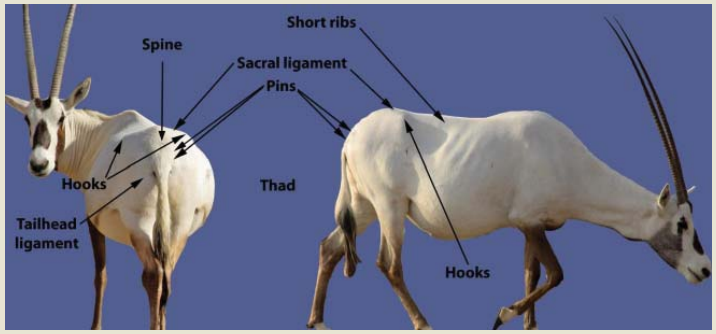


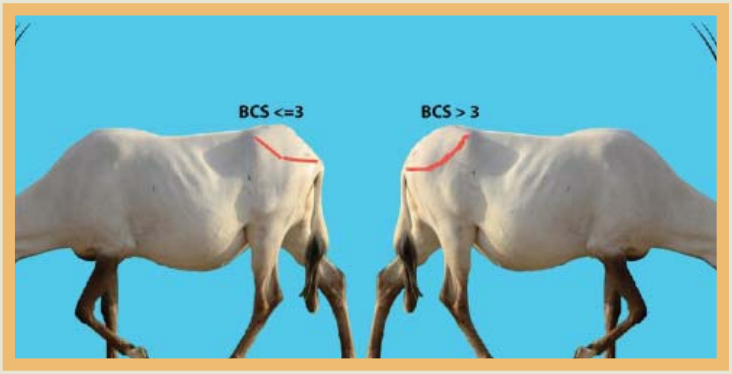
Figure (1) The body condition is assessed over the lumbar spine using a scoring system similar to those for cattle and sheep which subjectively estimates the degree of muscle and fat covering the lumbar vertebrae - EDMUND FLACH in The biology, husbandry and conservation of scimitar-horned oryx (Oryx dammah) Edited by Tania Gilbert and Tim Woodfine MARWELL PRESERVATION TRUST

The parts used in the scheme are illustrated in the following picture.



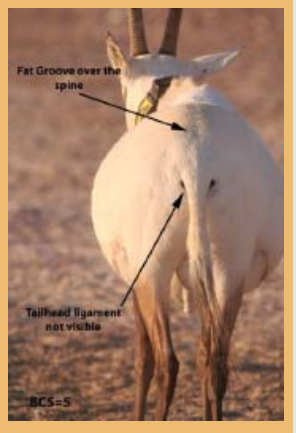
An average grade of a group of animals around the value of 3 is optimum expressing a fit and healthy population. On the other hand a value around 4 indicates fattened population and 5 is for obese animals. The other end of the scale shows animal in poor condition where 0 means emaciated condition, 1 is thin animal and 2 is an indication of malnutrition.

Method:
A key using those parts and features is formulated to be used along with photographs to assign values of body condition scores.
1- Assess thurl line (line between hooks, thurl, pins picture1)
• Thurl line is circular forming a crescent…BCS>3……(2)
• Thurl line is V-shaped …….BCS<=3……...……..(3

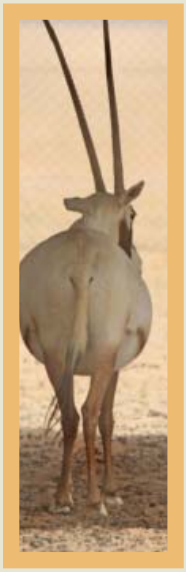


Picture (1) assessing the thurl line.

2- Assess the fat deposits at the spine over the tail head *(see pictures 2 &3)*
• Spine is fully covered in fat but tailhead ligament is visible .... BCS=4
• Spine is covered with fat forming a groove over the spine & tailhead ligament is not visible..……...BCS=5



Picture (2) left & Picture (3) right

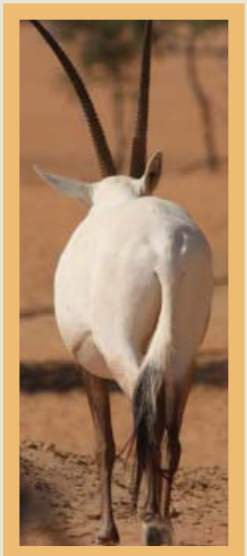


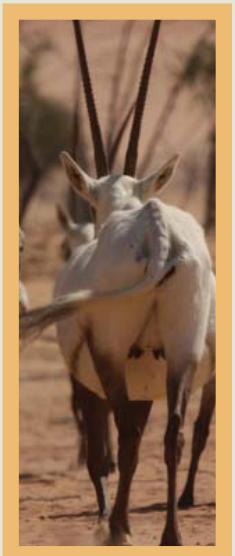
3- Assess the hooks (*pictures 4, left*)
• If the hooks are circular in outline ……BCS=3
• Hooks are angular in outline ……...……...(4)

4- Assess the fat cover over the pins
• If the fat cover is poor and only upper pins are visible or slightly visible…BCS=2
• Fat cover over pins is poor and 2 pairs of pins are visible…...(5)

Picture 5 (right) body condition score =2
5- Assess the fat cover over the pins
• Spine showing, 2 pairs of pins visible and shallow groove around tailhead ligament bu caudal vertebrae not visible ……BCS=1

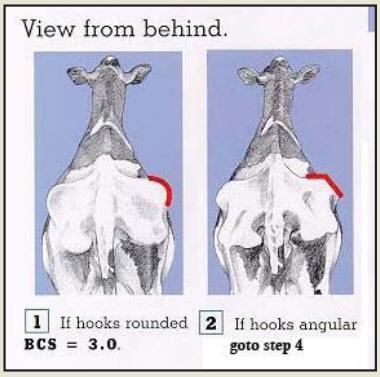
Picture 6 (right) emaciated animal with a condition score of "0"
• Spine strongly visible, 2 pairs of pins prominently visible, deep grooves a round tailhead ligament, and caudal vertebrae are visible....…….…….....BCS=0





Picture (5) left & Picture (6) right

EXAMPLE:
The method was applied to Arabian oryx herd reintroduced to Arabian Oryx Protected Area , AOPA in Abu Dhabi, UAE. Assessment was done on a monthly basis. Photographs of animals were taken using a 500mm lens and assessment was conducted using photographs not direct observation. Scores recorded for 2010 in AOPA. A pattern of decline in condition during the peak of breeding and nursing season (Feb. to April) was observed. Following, a pattern of pick-up of condition is observed during early summer. Sample size was 90 (±5) animals (see figure 2).



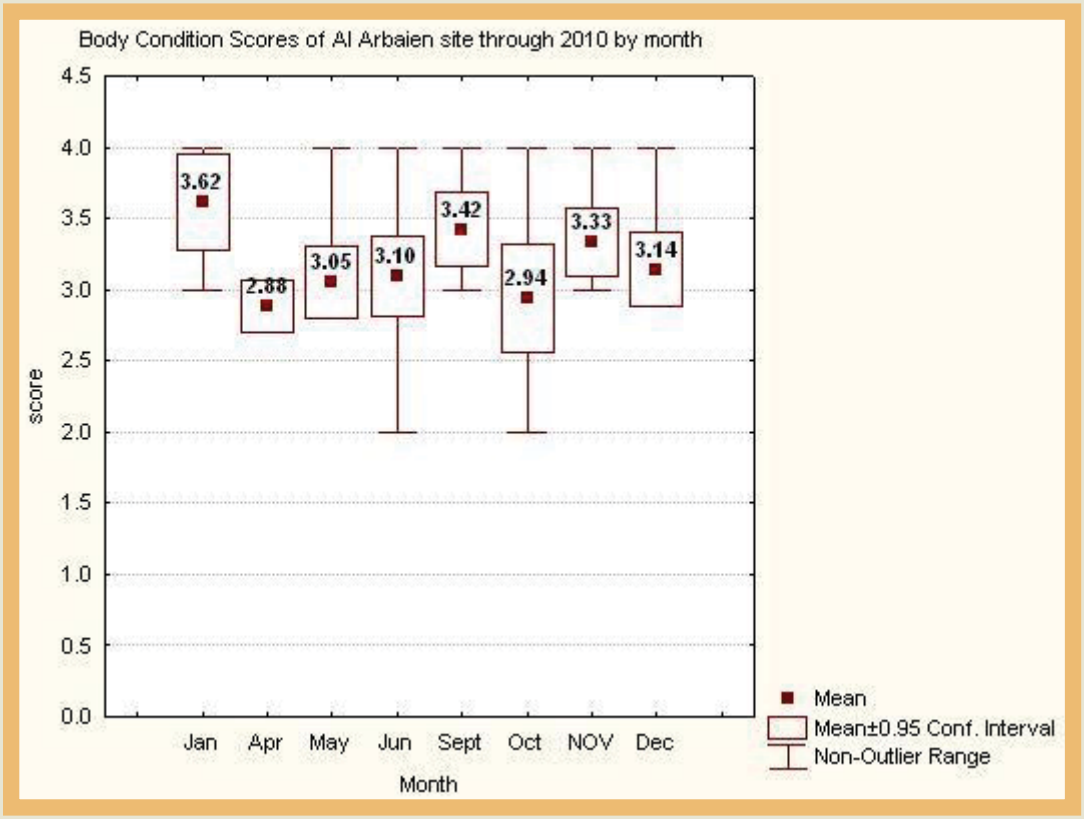


Figure (2) body condition scores of Arabian Oryx in AOPA during 2010 shoeing a pattern of declining score in breeding an nursing season (Feb. to April) followed by an increase in body condition score in early summer.

Ishaqbini's Hirola Sanctuary, the Final Stage: August 2012

- Juliet King

After more than two years of planning, the Ishaqbini hirola sanctuary is now successfully established with a founder population of 48 hirola, the world's most endangered antelope. It has involved enormous effort and commitment on the part of the Hara, Korissa and Kotile communities, Ishaqbini Conservancy management and NRT to reach this stage with considerable support from the KWS Hirola Management Committee and donors, TNC in particular. To my knowledge, this is the first large, fenced sanctuary on community land dedicated for the conservation of a critically endangered species, with an area of 2,740 ha set aside by the community for this purpose.

With a newly constructed headquarters, staff accommodation, workshop and water pipeline completed, Ishaqbini has all the infrastructure, equipment and personnel in place to independently manage the sanctuary. The impact of the sanctuary on the long-term conservation of hirola is likely to be seen within a few years, and there will no doubt be heightened scrutiny and attention from the national and international conservation community on Ishaqbini to determine the success, or otherwise, of the sanctuary. The profile of such a project cannot be underestimated, and NRT (or NCC) must continue to provide close mentorship and oversight to ensure that Ishaqbini has the capacity and support it needs to manage the sanctuary and monitor the hirola in the long-term.

The fence construction was a massive job that took 9 months, covered more than 22km and employed 80 casual workers from the community, managed by a team of expert fencing staff from Lewa Wildlife Conservancy led by Cosmos. For the past 5 months, NRT's Latif Boru has been based at Ishaqbini to oversee the final stages of the sanctuary and to continually update and liaise with the community on progress and plans. Two water holes have been constructed; a water pipeline, pump and storage tanks at headquarters; two hyena-enclosures/traps with one-way gates; and three access gates to the sanctuary. In the midst of this, the Ishaqbini Board elections were in turmoil, however there was a strong message from the community to allow the sanctuary to continue and for the Board issues to be sorted out separately.

With the fence almost complete, the hirola capture operation was scheduled for early August to avoid the peak breeding season of hirola. NRT's Research and Monitoring Assistant, Sinyati Lesowapir, was already in Ishaqbini and assisted by Mzee Kinyanjui was monitoring the presence of predators and other wildlife within the sanctuary and together with Ishaqbini ranger's identifying the target hirola groups for translocation. We arrived in Ishaqbini five days prior to the arrival of the capture teams, all that remained was to locate the hirola, clear the predators and close the fence – a big job in the few days that remained! Ian Craig and I in one Super-cub and NRT's Peter Lempatu and Ishaqbini Conservancy Warden, Mohammed Ismail, in a second Super-cub, flew early morning and evening recce flights to locate hirola herds and determine the exact number and composition of each herd and their distance from the sanctuary.

However, an unexpected start to the capture operation awaited us with the dramatic evacuation of Ian Craig who sustained serious injuries during a fall (we later discovered he had 7 broken ribs and a punctured lung). The remoteness of Ishaqbini was only too apparent during the 4-hours we waited for the medical team to arrive with a helicopter; first aid training and a satellite phone have gone up on our list of NRT priorities! Despite this set-back, Ian was determined for the capture to continue as planned. We soon realised that while each of us were aware of different pieces of the puzzle, Ian was the only person with knowledge on the 'whole' – the dynamics of hirola, fence, predators, water, capture and community that surround this project.

With Ian now out of the picture, Tom Lalampaa, NRT's ever-positive Community Development Manager immediately travelled to Ishaqbini to assist with leading community meetings in each of the locations. Rumbles from the community were apparent with concern of 'their' hirola being taken elsewhere as had happened in the

past. With Tom and Latif's reassurance and with support from the elders and Chiefs in each village, these fears were overcome and a team of 9 elders selected to join us for the duration of the capture operation.

On Monday 6th August the capture teams arrived from KWS, Ol Pejeta and Lewa led by KWS' Dr Isaac Lekolol and Batian Craig, with two helicopters, one from KWS and the other piloted by Lewa's Mike Watson. After a briefing and update on the status of the sanctuary, and a quick familiarisation of the area for the pilots and team leaders, a decision was made to keep the final 100m of fence open in order to herd in some hirola that were nearby. We were already aware of 12 hirola inside the sanctuary which had been moving in and out of gap in the fence over the previous week; these included several adult males, one juvenile and the majority adult females. On the first evening a mixed group of 10 adult hirola were successfully herded in through the gap in the fence using the helicopter, and the following morning another 2 hirola. With a total of 24 hirola now inside the sanctuary the gap in the fence was closed and work could begin on removing predators that remained inside – spotted hyena, leopard and cheetah.

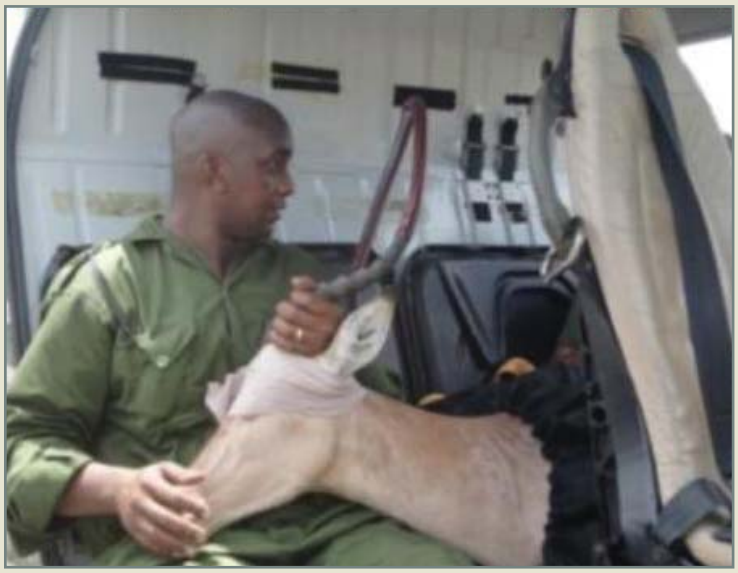
Removal of hyenas involved the use of night-time call-backs and baiting with meat and offal inside the hyena enclosures – an area of about 100m x 100m at two corners of the sanctuary which had been cleverly constructed with one-way gates that opened either into the sanctuary or to the outside. This system successfully removed at least three hyena from the sanctuary over several nights. Throughout the week, Sinyati, Kinyanjui and the Ishaqbini rangers tracked the spoor of several cheetah, a leopard and more hyena in the sanctuary. Box-traps were set in different locations and successfully caught three spotted hyena (and numerous civet and a caracal) which were released outside the sanctuary. Catching the cheetah was a far more onerous task which involved up to eight hours a day of tracking by Sinyati and Kinyanjui until the cheetah were sighted

at which time the Super-cub and helicopter were called in. Low level flying by the helicopter 'flushed' the cheetah out which were then chased by the helicopter weaving it's way between bushes until they could either be darted or lay down and caught by hand (by Batian and Isaac) in the case of four, three-quarter grown cubs. Several days of cheetah-tracking and hours of flying later, we successfully removed 6 cheetah from the sanctuary and released them outside. Removal of predators is ongoing, traps are set each night for the remaining two hyena and one leopard, and a plan to dart the one remaining cheetah is underway.

The focal area for the hirola capture was to the east of the sanctuary in an area known as Walkon, towards the edge of the Boni forest. It falls within the greater Ishaqbini area and has remarkable wildlife populations, in their recce flights during the previous week Peter and Mohammed had repeatedly located numerous herds of hirola, a total of about 100 individuals. These were found in patches of mixed grassland-bush areas adjoining the forest, inaccessible by vehicle. With the area for capture identified, the helicopters ferried all the capture nets, equipment and capture team on site. Setting of the nets required at least two hours and initially used several tons of equipment including heavy cables and poles, however, throughout the week the net system was refined to a series of parallel nets strung across about 100m between trees a much more manageable and lightweight system. The nets were generally moved on a daily basis, according to where the next target herd for capture was located and to minimize the distance over which hirola were herded to the nets.

While the ground teams waited, hidden in thick bush, Peter and Mohammed located an appropriate herd for capture within 2 km of the nets. Guiding Mike's helicopter in, the high-adrenaline work of capture began, the helicopter nimbly herding the animals slowly towards the nets, gathering each individual as it split from the herd and bringing them together again, pushing them along animal paths that led to the nets. Constant communication and instructions coming from Peter in the aircraft above to ensure Mike continued to move the herd in the right direction, with a final push from the helicopter a group of four or five animals would be split off from the herd and driven into the nets. The capture team remained hidden

until the hirola passed the outer edge of the net, at this point 'chaos' ensued with a blast from the 'vuvuzela' the team rushed from their hiding places towards the hirola which had run headlong into the nets, each person bravely leaping on the closest animal and re-straining it by the horns and back legs. Very quickly the vets, Isaac and Mathew Mutinda, administered a sedative to each captured female (and their young if present); all but one adult male hirola were released. Once sedated the animals' eyes were covered, horns protected with hose-pipe, legs bound with straps and each animal carefully put into specially made 'sacks' for transport.



The hirola were transported two per helicopter with a vet and han dler, and within half an hour of capture arrived at the holding pens in the sanctuary. Here another team of KWS, NRT, Ishaqbini and community members awaited, for the task of collecting blood and tissue samples, fixing ear tags and gathering various body measure-ments on each animal. Surprisingly heavy, each hirola needed five people to carry them from the helicopters to the holding pens, a per-fect way for the community elders to be involved and 'account' for each hirola as it came in from the capture site. Processing time at the holding pens was minimized and as far as possible the animals revived inside the pens within 15 minutes of arrival. The animals were kept in the holding pens for up to 12 hours, until effects of the sedative had worn off, after which the curtains of the pens were pulled aside and the animals released. No more than 5 animals were captured from any herd, due to the constraint of carrying only two adult hirola per helicopter.

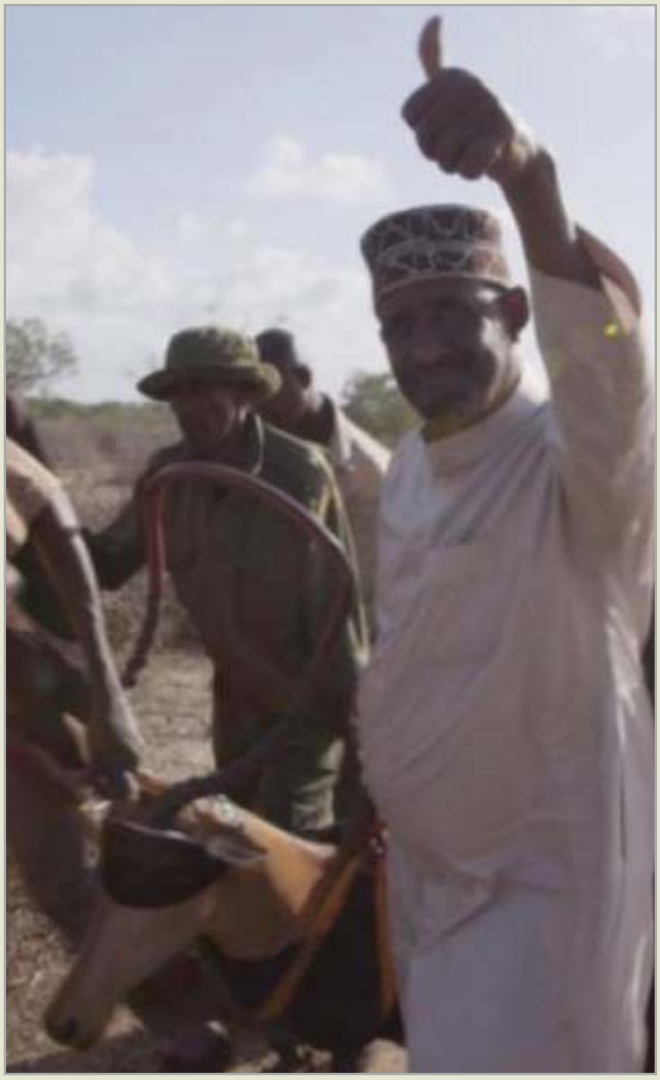
Over a period of 6 days, the capture team successfully caught 24 hirola in the nets; 17 adult females, 3 sub-adult females, 2 juve-nile males, 1 juvenile female and 1 adult male. There were no mortalities during the capture or at the holding pens, and only one hirola was injured during capture – a sub-adult whose left horn was broken in the net. At the time of writing this, 10 days after the capture was completed, no mortalities of hirola have been reported in the sanctuary. This is an incredible achievement, particularly for hirola which are renown for being particularly sensitive to capture stress; previous translocations of hirola have had mixed success and we embarked on this capture exercise with the expectation that we could lose a few animals. The fact that no hirola died during this capture is a testament to the professionalism of the KWS, Lewa and Ol Pejeta teams involved.

With the success of the capture operation, we now have 48 hirola within the sanctuary together with about 30 giraffe, 20 zebra, 8 topi, 2 oryx, numerous lesser kudu, gerenuk and dik-dik as well as smaller predators (civet, genet and caracal); the majority of large predators have been removed and the predator-proof, electrified fence is almost complete. Over the past week, Ishaqbini has had good rain which has replenished some of the dry water pans and

stimulated fresh growth of grass in the sanctuary, and surrounding area. The hope is that within a month the hirola will settle down and recover from the stress of capture, regroup in their small herds and begin to form territories within the confines of the sanctuary. Many of the females captured were pregnant and we hope to see the birth of new calves within a few months. Work on capturing the few remaining large predators continues and should also be finished within a month. A team of 4 Ishaqbini rangers are dedicated to monitoring hirola within the sanctuary and have been trained to identify individuals using ear-tags. They are also responsible for monitoring any signs of predators and now know how to use the traps. PhD student Ali Hussein is also going to be monitoring the hirola within the sanctuary and the wider conservancy, in order to determine survivorship of adults and juveniles in the different areas. Fence and water maintenance teams are being trained and will be employed by Ishaqbini Conservancy to ensure the entire fence is checked on a daily basis and any breakages are fixed immediately; continual provision of water in the sanctuary is also essential.

The translocation was the final stage of a substantial project to establish a predator-proof hirola sanctuary within the species' natural range; it has involved an enormous effort on the part of many people, too many to mention here. An often unacknowledged team is NRT's finance department, who keep the wheels in motion on all NRT projects, having accountant Fridah Kendi join us for the trip was a great help not only to the smooth running of the operation, but was also an opportunity for her to share in the experience; she was game for anything from baiting traps with stinking meat, to hiding in bushes with the capture team waiting to catch hirola – by the end of the trip she was grateful to be heading back to her quiet office and laptop!

The translocation marks the beginning for Ishaqbini Conservancy, under the management of Yussuf Aden and Mohammed Ismail, who now have the responsibility for managing and monitoring what is currently 10% of the world's remaining hirola. Genuine community ownership and responsibility of the sanctuary is essential and NRT's focus will shift to ensuring Ishaqbini has the capacity to effectively undertake this task. The communities' real attachment to hirola has been evident ever since NRT began working here in 2007 and was ever more so in the build up to the capture. The participation of elders in the capture operation, who joined in with the helicopters and ground teams, was invaluable and their first-hand feedback to the community regaling stories of helicopters manoeuvring through bushes chasing herds, the gentleness of hirola when captured, and *'a magical elder with red eyes and holes in his ears, who grows the tail of a hyena and mimics their calls in order to catch them'* – will be more powerful in entrenching the sanctuary as indisputably belonging to the community than any 'conservation awareness' we can do ourselves.



Notes on the silver Dik-dik *Madoqua piacentinii* Drake-Brockman, 1911 - Giovanni G. Bellani

Introduction

The dik-diks (genus *Madoqua*) are small antelopes mainly living in Northeast and East Africa, with an outlying population in Namibia and Angola. They are characterized by small size and the structure of the premaxillary and nasal bones which give a distinctive appearance to their face: the nose is crooked, rather 'long and mobile, with nostrils that often protrude forward from the chin. Another characteristic of the group is the erectile tuft of long hairs on the top of the head that often conceals the short horns of the males. Four species are recognized by Yalden (1978) and Grubb (2005) and a number of subspecies and forms have also been named (Table 1). There is chromosome and ecological evidence that *Madoqua kirkii,* is a complex of four species, *M. damarensis* in Namibia and Angola, and three species, *M. cavendishi, M. kirkii and M. thomasi* in East Africa (Kingswood et al. 1994, Kingswood and Kumamoto 1997, Kingdon 1997). In a more radical arrangement, Groves and Grubb (2011) recognized 13 species of dik-diks.

Table 1. Species and subspecies of the genus Madoqua

Species	Subspecies
M. kirkii	*kirkii, cavedishi, thimasi, damarensis*
M. saltiana	*saltiana, haraensis, swaynei, phillipsi, lawrancei*
M.guentheri	*guentheri, smithii*
M. paicentinii	Monospecific

Silver dik-dik

Silver dik-dik *M. piacentinii* is the least-well known of these forms, and is one of the very few antelopes classified on the IUCN Red List as Data Deficient (Antelope Specialist Group 2008). Silver dik-dik has sometimes been regarded as a subspecies of *M. saltiana* (Meester & Setzer 1974, Bellani 1997) but is more usually classified as a full species (Funaioli & Simonetta 1960, Yalden 1978, Grubb 2005).

Its range was originally believed to be restricted to the central coastal plain of Somalia, where it extended for no more than 10 km inland (Simonetta 1988, East 1999). East (1999) estimated this range at about 15,000 km², and its density at 2/km² and thus a maximum population of 30,000. No field surveys have been carried out in this region for over 20 years. Recently, silver dik-dik was reported and photographed in the Ogaden of Ethiopia (Wilhelmi et al. 2006), where it occurred sympatrically with *M. guentheri* and *M. saltiana*. Wlhelmi *et al.* (2006) estimated that its distribution in the region extended from 60 km south of Kebri Dehar to Wadi Shebelle and possibly eastwards to the Somali border, but that it was much less common than the other two species. This finding indicates that the species is more widely distributed than previously thought. Access to the Ogaden region is restricted, so field surveys are not possible at present. In Somalia, silver dik-dik occurs in dense low coastal thickets on fertile, sandy soils under an offshore wind that has a cooling effect (Kingdon 1997) (this area lies in the Hobyo grasslands and shrublands ecoregion) and in the Ogaden, in dense *Acacia-Commiphora* bushland (Wilhelmi et al. 2006).

Identification

Yalden (1978) distinguished *M. piacentinii* on the basis of consistently smaller size, uniform silvery coat color, and length of the upper tooth row. In order to supplement this information, to further investigate differences in coat color and to aid identification of individuals in the field or in collections, the following specimens and materials were examined:

- Skins of *M. piacentinii* from the collection of the Museum of Natural History, University of Florence, Department of Zoology "La Specola" *(Fig. 1)*

- Three specimens classified by me and part of the collection Faraggiana-Ferrandi in the Museum of Natural History in Novara (Italy) *(Fig. 2)*.

- An original photo of *M. piacentinii* taken by Professor A.M. Simonetta at the University of Florence (Fig 3).

Fig. 3. *M. piacentinii* (Prof. A.M. Simonetta).

Distinguishing features are:

- *M. piacentinii* is always smaller than *saltiana* (Head and body 45-50cm in *piacentini* and 52-67 cm in *saltiana*.

- In *M. piacentinii* the individual hairs are black at the tip, then a clear band almost creamy-white, and another band of dark brown that sometimes ends with a short reddish tinge; the rest of the hair is unicolored. The area of alternating light and dark bands is never longer than 5 mm, while the area of alternating color bands on the hairs of *M. saltiana*, always exceeds 5 mm (Fig. 4).
- *M. piacentinii* has a reddish tuft on the top of the head and a reddish spot on the nose, usually separated by grey fur on the forehead (see photos) In *M. saltiana*, the red color on the head forms a single patch and the forehead is largely reddish.
- The ears are proportionately smaller and the outer edge has a black rim (Yalden 1978), though M. saltiana sometimes also shows this feature.
- In *M. piacentinii* the white circle around the eyes is less apparent than in *M. saltiana.*

Conservation

De Georges & Reilly (2009) reported that in the 1960s, 350,000 skins of dik-diks per year were exported from Somalia to Europe. Amir (2006) also considered silver dik-dik to be among the species subject to capture and illegal export (along with other species of Somali antelopes). There is very little specific information available on population trends. Wilhelmi *et al*. (2006) considered that though less abundant than other dik-dik species in the Ogaden, it seemed to be stable, and they classified its regional status as not threatened. There are no protected areas within its known area of distribution. Although many potential threats are operative (hunting and poaching for meat and skins, capture for export of live animals, overgrazing and degradation of habitat) their impact is unknown and the resilience of the species cannot be assessed.

Until recently, it was believed that there were no specimens in captivity. However, Moscow Zoo has recently been shown to hold a small number of silver dik-diks, based on the identification characters detailed above *(Figs. 5-6).* Unfortunately there are no precise details of the origin of these animals and there are too few to form a robust captive breeding population.

Given the political and economic situation in Somalia, and the situation in the Ogaden, it is unrealistic to hope for even a minimum involvement by government bodies in its conservation. Establishing its actual distribution and population size is urgently needed, but field surveys are likely to remain impractical for the near future at least. One much needed – and realistic - initiative is a detailed analysis of the DNA of *Madoqua* to clarify the relationship between *M. piacentinii* and *M. saltiana*, and the number of distinct taxa within the genus overall and their relations to each other.

Acknowledgements

I am grateful for the help of the following: The Museum of Natural History Faraggiana-Ferrandi in Novara (Italy), The Museum of Natural History, University of Florence (in particular the Section of Zoology “La Specola”), Professor Alberto M. Simonetta, Mr. Sergey Yeliseev and Mr. Nicolay Usik for their photo of specimens at the Moscow Zoo, Dr David Mallon.

Fig.7 *M. piacentinii* at Moscow Zoo.

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New information on captive hirola supports current conservation actions

James Probert, Ben Evans and Rajan Amin

The hirola (*Beatragus hunteri*; Sclater, 1889) is currently classified as critically endangered by the International Union for the Conservation of Nature and Natural Resources (IUCN, 2008). The population suffered a 90% decline in the 1980's and is the most threatened species of monotypic antelope on Earth (Magin, 1996a; Kock *et al*., 2010). It is the only extant member of its genus and its extinction would be the first loss of an entire mammalian genus in Africa since the evolution of modern man (Gentry, 1990; King *et al*., 2011).

The global hirola population is estimated at only 501 individuals. These individuals exist in two subpopulations: a natural population of 434 on the Kenya-Somali border and a translocated population of 67 in Tsavo East National Park, Kenya (King *et al*., 2011; Probert, 2011; Evans 2011).

Predation is a major limiting factor in the growth of the hirola population in its natural range. Research in the Ishaqbini Hirola Community Conservancy found that hirola made up 20% of lion scat, 10% of hyena scat and 4% of leopard scat (Gibbon, 2010).

The largest ongoing conservation effort by the Hirola Management Committee (HMC) is the construction of a 27.7 km^2 predator proof fenced sanctuary in Ishaqbini at an estimated cost of over US$800,000. Construction has already begun and further sanctuaries are proposed in Arawale Game Reserve and Tsavo East National Park (Omari, 2011; Kock *et al*., 2010). Simulations *in silico* have suggested that in the absence of predation hirola will breed well but data on previous captive populations has not appeared in the literature. This article aims to assess the breeding potential of a sanctuary population by examining previously unpublished data on captive populations.

There are currently no hirola in captivity but Butynski (2000) states that historically four zoos worldwide have held hirola: The Gladys Porter Zoo in Brownsville, Texas, San Diego Zoo in California, Tampa Zoo in Florida and Dvur Kralove Zoo in Czechoslovakia. Figures concerning the hirola in Dvur Kralove Zoo are published in Smielowski (1987) and details for The Gladys Porter and San Diego Zoos were obtained by the author from the zoos themselves. This is the first time figures for the hirola in The Gladys Porter and San Diego Zoos have appeared in the literature. In correspondence with the author Dr. Larry Killmar, Vice President and Director of Collections at Tampa Zoo states that Tampa Zoo has never held hirola in their collection.

Dvur Kralove Zoo imported 2 male and 5 female hirola sub adults from Kenya in 1971. The population produced 19 calves in 11 years (7 males and 12 females) although juvenile mortality was 32%. If a calf survived past 6 months of age the mean life expectancy was 14 years. Mycobacteriosis destroyed the herd in 1981 (Smielowski, 1987).

San Diego Zoo held a total of 3 male and 3 female hirola. A single calf was born and the last surviving hirola was transferred from the zoo in 1986 (San Diego Zoo Customer Service Team, *pers. comm*.).

The Gladys Porter Zoo imported 2 male and 2 female hirola in 1972. A further 2 females were received in 1972, 2 males and 3 females in 1978, 1 male in 1980 and 1 male in 1987. A total of 19 calves were born between 1974 and 1991 (11 males and 8 females) bringing the population of hirola in The Gladys Porter Zoo to 32 at its peak (17 males and 15 females). The zoo's oldest hirola was a female which reached 15 years of age. The last hirola, a female, died on 17th November 2002 at 12 years of age (Thomas deMaar and Diana Lucio, *pers. comm*.).

The information above suggests that hirola breed well in captivity. With the proposed sanctuary at Ishaqbini containing four hirola herds this captive in situ population could significantly bolster hirola numbers in Ishaqbini.
In addition to this there is a body of information and expertise in the form of the zoo professionals who cared for captive hirola. Many of these professionals are still working and they were able to provide details of the conditions and food that captive hirola favoured. Their knowledge is an invaluable resource for maintaining a sanctuary population.

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On the greater kudu, *Tragelaphus strepsiceros* , in southern and central Somalia

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The availability of detailed data concerning the geographic distribution of taxa has been increasingly recognised as an important tool for biodiversity studies and conservation planning. However, many museum collections remain largely unexplored to such an end. This is unfortunate as voucher specimens define the unequivocal presence – former or current – of a taxon and enable its systematic revision, seemingly very necessary, even in the case of well-known taxa such as African ungulates (Cotterill 2003).

In a recent article, Rallo (2000) while describing a small collection of Somali vertebrates donated by Mr. Napoleone Forin to the Museo Civico di Storia Naturale in Venice, listed, without comments, two greater kudu, *Tragelaphus strepsiceros* (Pallas, 1766), trophies (3396 and 3399) collected between 1961 and 1969 from Dinsor (=Dhiinsoor), Bay Region, southern Somalia (Figure 1).

Figure 1 Map of Somalia showing the localities cited in the text.

This is of interest as the species had previously been found only in northern Somalia (the former British Somaliland), but not in the former Italian Somalia (Tedesco Zammarano 1930 , pp. 196 – 197) except for some marginal areas (Simonetta 1988 ; see below). Yet, it should be noted that Pavesi (1899) had reported the species, without further details, from the " Merehan Region, " just north of the Sheebeli River, on the basis of materials collected by Robecchi Bricchetti in 1891. Funaioli and Simonetta (1966) and Funaioli (1971) confirmed the presence of the species north of Sheebeli River, near Belet Weyn, close to the Ethiopian border. The presence of the greater kudu along the Kenyan and Ethiopian borders (Lugh Ferrandi District) and in the Dinsor interfluvial area was reported by Funaioli (1957) on the basis of verbal communications obtained while investigating the origin of the trophies found in the Mogadishu market. Subsequently, regarding the greater kudu distribution in Somalia (Funaioli and Simonetta 1966), no further references to the region of Dinsor were made owing to a lack of verifi able records (Funaioli *pers. comm*. 2010). In the south, only one specimen of known origin has been reported thus far, from the Mata Harba Hill (around 3°30′ N), Lugh district, close to the Kenyan border (Funaioli and Simonetta 1962). Later, Funaioli (1971) reported its presence only from " alto Hiran " (near Belet Weyn) and Haud (former Somaliland). In a little known article, Scaramella (1984) reports the direct observation of one kudu between Dolo and Mandera. One of us (F.F.) has added an interesting record of the greater kudu from around Dhusa Mareb (5°32′15″ N–46°23′15″ E), Galguduud Region, taken in 1971 (Figure 2). This latter record extends the known range of the species in central Somalia into the North-Eastern direction (Funaioli 1971).

Mr. Forin, a former big game hunter with decades of experience in southern Somalia, confirmed that the two Venice specimens were the only two greater kudu he had obtained in Somalia during his activity as a game hunter, while a third trophy was acquired at the Mogadishu market. One specimen was collected some kilometres east of Dinsor (2°24′0″ N– 42°59′0″ E), while another originated from a few kilometres south of Lug Ferrandi (= Luuq, 03 °47′30″ N–42°32′50″ E).

Publications

Comparative Phylogeography of African Savannah Ungulates

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A shorter version of the publication: Lorenzen ED, Heller R, Siegismund HR (2012) Invited review: Comparative phylogeography of African savannah ungulates. Molecular Ecology 21, 3656–3670. For ease of reading and due to space constraints, references have

been omitted from this summary. For a pdf of the original manuscript or further details, please email elinelorenzen@gmail.com

Biogeographic insights from genetic data

Phylogeography is the study of the geographic distribution of genetic lineages. In combination with population genetic inference, it provides a powerful approach to elucidating the evolutionary processes that have shaped present-day diversity within and among species. Comparative phylogeography uses data from taxa with varying life history traits, habitat preferences and ecological requirements to elucidate the historical biogeography of a region.

Within the past two decades, phylogeographic studies have been published on two-dozen ungulate taxa from sub-Saharan Africa. With the rapid accumulation of data from large-scale studies, the time is ripe to synthesise the work and summarise the overall findings. In this review we explore data from 19 ungulate taxa for which region- and continent-wide data exist (Table 1). The taxa are ecologically associated with savannah ecosystems, although each has unique habitat preferences and life history traits. Most of the taxa included are medium-sized and large bovids, reflecting the predominance of the group within the herbivore guild. We focus on major biogeographic signals within each taxon and evaluate community-wide patterns in the context of Pleistocene climate change.

An introduction to Pleistocene climate

The distribution and biomass density of ungulates is clearly associated with the distribution of savannah habitat (Fig. 1a). Around 80% of ungulates belong to the bovid family and the emergence and evolutionary success of the group is closely linked the increase in open habitats and grassland formations at the onset of the Pleistocene c. 2.8 million years ago.

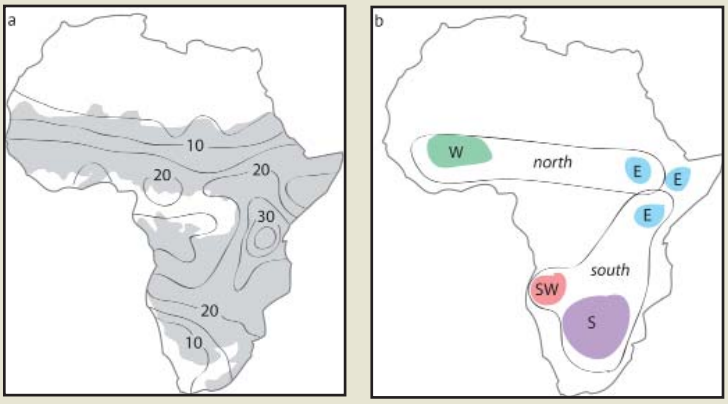

Figure 1 *Distribution, diversity and regional biogeography of ungulates across sub-Saharan Africa. (a) Isoclines of ungulate diversity across Africa, with the distribution of savannah in gray shading. (b) Biogeographic regions discussed throughout the text and in Box 1. Two continental areas on either side of the tropical forests of central Africa (north, south) encompass four regions: west (W), east (E), south (S) and southwest (SW). In many taxa, East Africa harbours several endemic lineages, and in addition, the area represents a suture zone between lineages from other biogeographic regions.*

The physiography of sub-Saharan Africa varies, but for convenience and as far as the distribution of wide-ranging species are concerned, the region can be divided into two major vegetation zones: savannah and tropical forests. The distributional balance between the two is governed by precipitation. Climate variability in tropical Africa during the Pleistocene mainly resulted in changes in levels of precipitation, with oscillations between warm, wet periods (pluvials) and cooler periods of reduced humidity (interpluvials). Pollen records from marine sediments covering several Pleistocene glacial-interglacial cycles indicate the repeated expansion and contraction of savannah and forests. During dry interpluvials, the decrease of CO2 and precipitation facilitated an increase in savannah coverage; southern hemisphere grasslands shifted northwards and West African savannahs expanded at the cost of lowland forests. During moist pluvials, the scenario reversed and grasslands were replaced by expanding tropical forests.

The distributions of savannah herbivores would have shifted in accordance with vegetation change. The maintenance of isolated grassland refugia—core areas of stable savannah habitat—during moist pluvials would have enabled the continued survival of savannah-adapted taxa. Over time, species genomes would diverge, shaping differences between populations in behaviour, morphology and ecology.

Major biogeographic patterns in sub-Saharan Africa

Across species, one major genetic signal has emerged: the phylogeographic structuring of regional populations (Fig. 2, Box 1). As shown in Figure 1b, we have defined two overall areas, north and south, indicating their periodic separation by an equatorial forest belt during moist pluvials. North represents the Sahel and encompasses biogeographic regions in the west and east. South includes southern Africa and is split into regions in the east, south and southwest. During dry interpluvials, south joins and overlaps with north in East Africa, which therefore represents a melting pot of long-diverged lineages across many taxa.

Although the level and pattern of differentiation and diversity vary among taxa, and sample localities and -sizes differ, most show significant structuring between at least two biogeographic regions as detailed below (Fig. 2, Box 1). Differences among taxa reflect unique evolutionary trajectories, including taxon-specific responses to common biotic and abiotic factors and the distinct demographic history of each individual population.

Divergence driven by environmental change

Phylogeographic data from western Africa are available from seven of the nine focal species found in the region (Fig. 2, Box 1). For species whose ranges extend into southern Africa, all but buffalo are structured north and south of the equatorial forest belt. Similar north/south structuring is observed in species from other taxonomic groups, indicating common cause. These include ostrich and white-tailed mongoose, both of which are widely distributed across sub-Saharan African savannahs. The signal further permeates trophic levels and is reported in apex predators whose distributions are determined by prey abundance, including lion and spotted hyena.

BOX 1: SPECIES SUMMARIES

The following data summaries are intended as an extended figure legend for the biogeographic maps presented in Figure 2, where we outline major phylogeographic patterns within each of the 19 reviewed taxa (references in Table 1).

We indicate current range distributions in parentheses () after the taxon name, corresponding to the grey shading in Figure 2. Non-sampled regions are indicated with []. For example, hippopotamus is found across sub-Saharan Africa, but genetic data are only available from East and southern Africa, hence its distribution is denoted ([W]-E-S-[SW]). The biogeographic regions of north, south, W, E, S and SW discussed below correspond to the areas indicated in Figure 1b.

1. Impala (E-S-SW) Phenotypically distinct and geographically isolated black-faced impala in the SW is genetically distinct. Population in Samburu, Kenya, is genetically distinct, suggesting several lineages in the E.

2. Hartebeest (W-E-S) Pronounced differentiation between north and south. Additional phylogeographic structuring is found within each area, indicating several splitting events. There is a suture zone in East Africa. Genetic analysis suggests an eastern origin of extant lineages and one or more eastern refugia.

3. Wildebeest (E-S-SW) Genetic data from the east groups within the diversity of the south, suggesting a pattern of colonization from E to S.

4. Topi ([W]-E-S) Data from the south groups within the diversity of the east, suggesting a pattern of colonization from S to E.

5. Grant's gazelle(s) (E) Three genetic lineages, with geographically distinct and limited distributions, indicating local divergence and several refugia in East Africa. No evidence of interbreeding among lineages in areas of contact, suggesting reproductive isolation.

6. African buffalo (W-E-S-SW) Clear divergence between two groups within north, which are recognised as distinct subspecies. The W group includes the SW, which is not seen in other taxa. The E group includes populations from the S, which was colonized relatively recently.

7. Common eland (E-S) Strong phylogeographic signal between E and S, which overlap in the East African suture zone. Genetic analysis suggests differing evolutionary scenarios in east and south and a younger origin of eastern populations.

8. Greater kudu (E-S-SW) Genetic data distinguish Namibian populations in the SW from the rest. Genetic analysis suggests a southern African origin. One northern Kenyan sample is genetically distinct, suggesting several lineages in the E.

9. Roan (W-E-S-[SW]) Phylogeographic structuring between W and the sampled populations in E and S. There is no structuring within the E+S clade.

(continued on page 18)

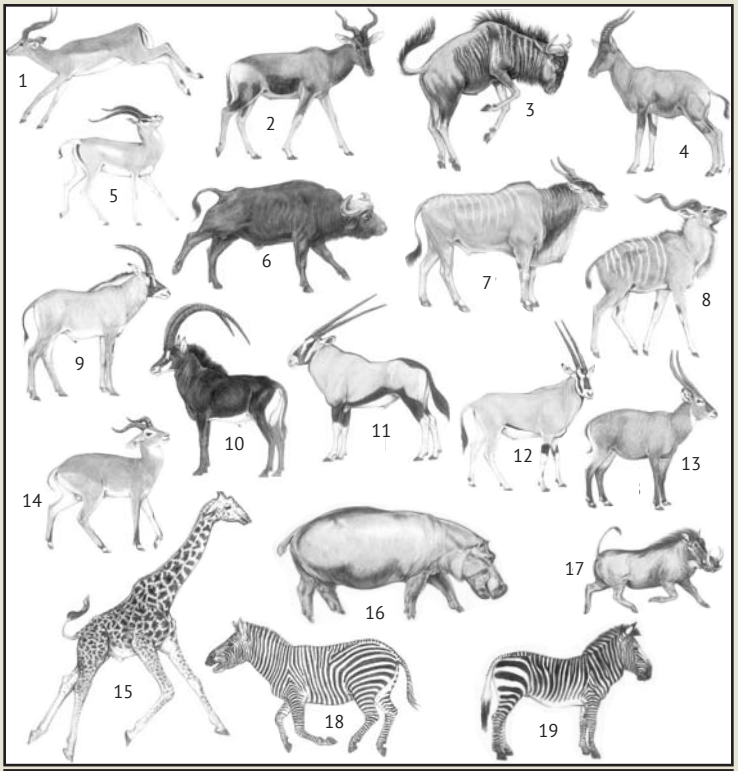

Figure BOX 1 *The 19 ungulate taxa included in this review (not to scale); illustrations by Jonathan Kingdon reprinted with permission.*

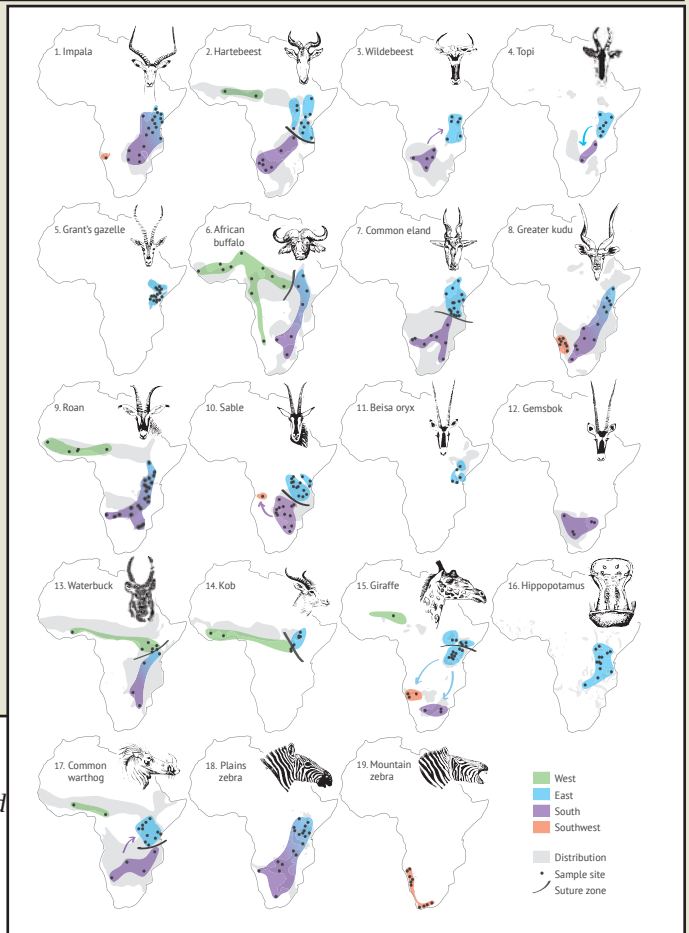

Figure 2 *Major biogeographic patterns of the 19 ungulate taxa included in this review inferred from phylogeographic data (further information in Box 1). Current species distributions based on the IUCN red list are shaded in grey; dots indicate DNA sampling localities. Due to the large number of localities sampled in buffalo, only the midpoint of each sampled country is shown. The four biogeographic regions correspond to those shown in Figure 1b: west (green), east (blue), south (purple), southwest (red). Arrows depict colonisation between regions, where this has been inferred from genetic data; the colour and direction of the arrow indicates the source area. Thick black lines indicate the locality of the East African suture zone, where biogeographic lineages meet. Ungulate illustrations by Jon Fjeldså.*

10. Sable (E-S-SW) Strong phylogeographic structuring among three genetic lineages. Two lineages are limited to the E, indicating several splitting events in the region. Genetic analysis suggests a southern origin and a suture zone in East Africa. A genetically distinct SW population, represented by the giant sable in Angola, is nested within the S lineage.
11. Beisa oryx (E) Three distinct groups, suggesting several splitting events in the E.
12. Gemsbok (S) No phylogeographic structuring.
13. Waterbuck (W-E-S) Distribution of phenotypically and geographically distinct subspecies corresponds to north and south, and subspecies are genetically distinct. They meet across a limited area in the East African suture zone, with little admixture.
14. Kob (W-E) Two well-diverged genetic groups. A limited suture zone is present in East Africa, with movement of genetic material from white-eared to Uganda kob.
15. Giraffe (W-E-S-SW) Significant divergence among six groups. The strongest split is between north and south; additional phylogeographic structuring is found within each group, indicating several splitting events. Genetic data suggests a suture zone in East Africa with admixture between lineages.
16. Hippopotamus ([W]-E-S-[SW]) No phylogeographic structuring, although genetic analysis shows a signal of expansion and suggest the (sampled) populations originated in the east.
17. Common warthog (W-E-S-[SW]) Three regional lineages in W, E and S. Genetic analysis suggests an origin in the south.
18. Plains zebra (E-S-SW) No phylogeographic signal. Significant levels of gene flow may have masked a past splitting event, as two widely distributed genetic lineages are differentiated by three substitutions.
19. Mountain zebra (SW) No phylogeographic structuring.

We attribute the pronounced north/south split to the periodic confinement of populations to the two continental areas. An increase in tropical forest across central Africa during pluvials would present an impenetrable barrier to gene flow between populations of savannah taxa isolated on either side. The Pleistocene included at least five full pluvial cycles, and the repeated shifts of the two major vegetation zones formed the composition of species gene pools, facilitating the emergence and evolution of many bovid taxa.
In the taxa that show additional phylogeographic structuring, the Sahelian populations are split into groups in the west and east. The differentiation between populations north and south of the equatorial forest belt remains the most pronounced, suggesting several splitting events. This divide is also found in several other savannah taxa, including red duiker, white-tailed mongoose, Guinea multimammate mouse, African common toad and ostrich. Similarities across taxonomic groups indicate common cause and suggest ecologically driven divergence within the Sahel.

Ecologically driven divergence is supported by indirect data from the first tropic level. The maize stalk borer Busseola fusca is a pathogen of domesticated C4 plants, and shows similar phylogeographic structuring of west and east. Although currently associated with cultivated plants, the biogeographic history of the stalk borer mirrors that of its wild C4 host(s) before domestication, as the organisms co-evolved over evolutionary timescales.

East Africa: a cradle of diversity
The highest diversity of African ungulates is in East Africa (Fig. 1a), and many of the reviewed species have endemic sister taxa in the region, including lesser kudu, desert warthog and Grevy's zebra. The high diversity between species is mirrored by the high diversity within species, and seven of the focal taxa have several genetic lineages within East Africa (Fig. 2). The limited range of the East African lineages indicates local divergence, and phylogeographic

Table 1 Overview of the 19 ungulate taxa included in this review. We have included information on biogeographic regions inferred from phylogeographic data (west (W), east (E), south (S), southwest (SW); Fig. 3, Box 2), the presence of several lineages and/or a suture zone in East Africa, genetic markers used, level of differentiation among regions (Φ_{CT}/θ_{CT}) and study references.

No	Common name	Family	Subfamily	Scientific name	Regional hierarchy	Multiple east	Suture zone	Control region bp	Control region n	Control region Φ_{CT}	*Cyt* b bp	*Cyt* b n	Microsatellites # loci	Microsatellites n	Microsatellites θ_{CT}	Reference
1	Impala	Bovidae	Aepycerotinae	*Aepyceros melampus*	E-S, SW			c. 400	155	0.34*	364	27	8	162	0.19*	Nersting & Arctander (2001); Lorenzen & Siegismund (2004); Lorenzen *et al.* (2006a)*
2	Hartebeest	Bovidae	Alcelaphinae	*Alcelaphus buselaphus*	W, E, S	x	x	486	170	0.68†	417	11				Arctander *et al.* (1999)‡; Flagstad *et al.* (2001)
3	Wildebeest	Bovidae	Alcelaphinae	*Connochaetes taurinus*	E, S			388	123	0.54						Arctander *et al.* (1999)
4	Topi	Bovidae	Alcelaphinae	*Damaliscus lunatus*	E, S			370	64	0.70						Arctander *et al.* (1999)
5	Grant's gazelle	Bovidae	Antilopinae	*Nanger granti*	E	x		375	177	0.74						Lorenzen *et al.* (2007b)
6	Buffalo	Bovidae	Bovinae	*Syncerus caffer*	W-E, E-S		x	358	766	0.42			17	209	*NA*	Van Hooft *et al.* (2000, 2002); Smitz *et al.* (in press)‡
7	Common eland	Bovidae	Bovinae	*Taurotragus oryx*	E, S		x	414	122	0.52						Lorenzen *et al.* (2010)
8	Greater kudu	Bovidae	Bovinae	*Tragelaphus strepsiceros*	E-S, SW			c. 400	90	0.40						Nersting & Arctander (2001)
9	Roan	Bovidae	Hippotraginae	*Hippotragus equinus*	W, E-S			401	137	0.49			8	137	0.26	Mathee & Robinson (1999); Alpers *et al.* (2004)‡
10	Sable	Bovidae	Hippotraginae	*Hippotragus niger*	E, S, SW	x	x	496	106	0.82†	343	40				Mathee & Robinson (1999)‡; Pitra *et al.* (2002, 2006)
11	Beisa oryx	Bovidae	Hippotraginae	*Oryx beisa*	E	x		423	58	0.55	666	19				Masembe *et al.* 2006

clades appear to be maintained despite the lack of contemporary barriers to gene flow.

High spatial heterogeneity in both quantity and quality of food resources has been invoked as one of the main drivers of ungulate diversity. We argue that, in addition, high levels of temporal heterogeneity unique to East Africa shaped the exceptional diversity of the region. East Africa has been characterised by highly interchangeable environments over the past 2 Ma; local environments have been affected by the volcanism and tectonism associated with the uplift of the Rift Valley, and global climates contrasting between very dry and very wet have caused the periodic disappearance and reappearance of the large deep lakes in the East African Rift valley.

Suture zone in East Africa

A suture zone is an area where lineages that have diverged in separate and non-overlapping geographic regions come into contact. East Africa represents such a zone, where major biogeographic lineages from different regions meet and overlap. The extent and form of contact varies across taxa and ranges from admixture to speciation.

The location of the contact zone varies, depending on the geographic origin of lineages (Fig. 2). In kob and buffalo, Sahelian lineages from west and east meet in Uganda. Distinct ecotypes of other taxa also overlap in here, including forest and savannah elephant. In hartebeest, waterbuck and giraffe, where lineages diverged north and south of the central African forests, the suture zone is located in Kenya and Tanzania. Ostrich shows a similar pattern, and plains zebra and Grevy's zebra also overlap in Kenya, producing fertile offspring. In eland and sable, whose geographically separated lineages from east and southern Africa meet, the contact zone is shifted to central Tanzania. In warthog, which shows similar regional structuring, the zone is found yet further south.

Differing evolutionary scenarios in east and south

Most of the reviewed species are distributed across east and southern Africa, and many show phylogeographic structuring (Fig. 2). In most cases, the divergence follows the east–south axis of open formations in southern Africa. A similar regional divide is reported across many diverse savannah species including ostrich, fiscal shrike, four-striped grass rat, cheetah and African wild dog.

In several species, genetic data from East Africa suggest the region was colonised from the south (Box 1), which may reflect the replacement of populations following local extirpation. Less pronounced phylogeographic structuring and higher levels of genetic variation in southern Africa across taxa suggest a large, long-standing population in the region, in contrast to the mosaic of refugial populations in the east. This is supported by palaeoclimate proxies, which indicate stable levels of moisture throughout the Pleistocene and greater environmental stability in the south. A continuous southern African refuge area would act as a museum, conserving populations and species over evolutionary timescales.

Location of Pleistocene refugia

Although species distributions change through time due to local extirpations, replacements and the colonisation of new areas, we can use the current distribution of genetic lineages to infer the putative geographic location of past refugia. The concordance among phylogeographic patterns observed across the ungulate assemblage strongly suggests the presence of Pleistocene refugia in west and southern Africa, and a mosaic of refugia in East Africa (Fig. 1b). Genetic data from four of the reviewed species (Fig. 2) indicate an additional refuge area in the southwest. This hyper-arid region is characterized by high floral endemism and also harbours the endemic mountain zebra, a sister species of plains zebra.

CONCLUSIONS

Evaluating two decades of published studies, we conclude that co-distributed ungulate taxa show a striking level of phylogeographic concordance, a pattern mirrored in species from other assemblages and trophic levels. We present evidence that ecological shifts associated with Pleistocene climate change shaped taxonomic diversity. Oscillations between warm, wet and cool, dry climates facilitated several divergence events. During moist pluvials, forests displaced savannahs, isolating populations of arid-adapted species. In turn, savannahs expanded at the expense of forests during dry interpluvials, enabling secondary contact among diverged lineages. The signal of regional structuring across taxa indicates that Pleistocene savannah refugia were located in west, south and southwest Africa, with a mosaic of spatial and temporal refugia in East Africa.

Modeling habitat quality of the mountain nyala T*ragelaphus buxtoni* in the Bale Mountains, Ethiopia

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Abstract

Populations of the endangered mountain nyala *Tragelaphus buxtoni* are significantly threatened by the loss of critical habitat. Population estimates are tentative, and information on the species' distribution and available habitat is required for for¬mulating immediate management and conservation strategies. To support management decisions and conservation priorities, we integrated information from a number of small-scale observational studies, interviews and reports from multiple sources to define habitat parameters and cre-

ate a habitat quality model for mountain nyala in the Bale Mountains. For our analysis, we used the FunConn model, an expertise-based model that considers spatial relationships (i.e., patch size, distance) between the species and vegetation type, topography and disturbance to create a habitat quality surface. The habitat quality model showed that approxi¬mately 18,610 km^2 (82.7% of our study area) is unsuitable or poor habitat for the mountain nyala, while 2,857 km^2 (12.7%) and 1,026 km^2 (4.6%) was ranked as good or optimal habitat, respectively. Our results not only reflected human induced habitat deg-radation, but also revealed an extensive area of intact habitat on the remote slopes of the Bale Mountain's southern and southeast¬ern escarpments. This study provides an example of the roles that expert knowledge can still play in modern geospatial modeling of wildlife habitat. New geospatial tools, such as the FunConn model, are readily available to wildlife managers and allow them to perform spatial analyses with minimal software, data and training requirements. This approach may be especially useful for species that are obscure to science or when field surveys are not practical [*Current Zoology* 58 (4): 524–534, 2012].

Received July 30, 2011; accepted Dec. 4, 2011.
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The curious case of *Gazella arabica*

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Abstract
Gazella arabica Lichtenstein, 1827, a gazelle species currently classified as "data deficient" on the IUCN Red List, has puzzled researchers for more than a century. The type specimens have repeatedly been classified as subspecies of *G. gazella, G. dorcas* or a distinct species since their first description about 180 years ago. Especially the skull is causing problems, as no similar gazelle individual has ever been found. We unravel the identity of *G. arabica* by sequencing two mitochondrial markers from the skull and skin which constitute the *G. arabica* lectotype and by performing a phylogenetic analysis of the genus. The results show that the lectotype skull and skin are not derived from the same animal. They belong to
two individuals representing the two monophyletic lineages within the Mountain gazelle clade, *Gazella gazella*. By tracing the taxonomic history of *G. arabica* and following the rules of the ICZN we are able to resolve the hypodigm of *G. arabica*.

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Conservation genetics of the endangered Dorcas gazelle (*Gazella dorcas spp.*) in Northwestern Africa

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Conservation Genetics
DOI 10.1007/s10592-012-0348-8
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Abstract
Abstract Large mammals are seriously threatened in North Africa, with emblematic cases of extinction reported during the twentieth century. The Dorcas gazelle (*Gazella dorcas*) is an endangered species whose populations drastically declined in the last few decades. In this work we applied both invasive and non-invasive molecular methods to document for the first time patterns of genetic diversity and population structure of *G. dorcas* in its northwestern range, using 13 microsatellite loci and a 716 bp fragment of mitochondrial DNA in seven populations (one wild, four semi-captive and two

captive). Genetic diversity at both mtDNA and nuclear markers showed a clear dichotomy among *G. dorcas* populations. While the wild population and the captive population maintained in Almeria (Spain) exhibited appreciable levels of diversity, all five captive and semi-captive populations across Morocco were fixed for a single mtDNA haplotype and showed low values of nuclear diversity. The allele frequency spectrum analysis of these five populations revealed profiles expected under a bottleneck scenario, but statistical tests performed to investigate this situation were not significant. Genetic differentiation measured by summary statistics (FST and Dest) and population structure revealed by Bayesian clustering analysis suggest that the Sidi Chiker Reserve, in the northern plains of Morocco, may harbour the last individuals belonging to *G. d. massaesyla*, while individuals from the El Kheng Reserve exhibited a moderate degree of differentiation and could not be unambiguously associated with one of the two remaining putative subspecies. These data should be taken into consideration in order to implement a conservation action plan for *G. dorcas* in Morocco.

Influence of population density on group sizes in goitered gazelle (*Gazella subgutturosa* Guld., 1780)

David Blank, Kathreen Ruckstuhl, Weikang Yang
European Journal of Wildlife Research December 2012, Volume 58, Issue 6, pp 981-989

Abstract
We conducted our study in Ili depression, south-eastern Kazakhstan during 1981–1989 to investigate how group sizes and group class frequencies change with increasing population densities in goitered gazelles. In addition, we compared our study to data on group size and group class frequency of various goitered gazelle populations in Kazakhstan with very variable population densities. We found that mean group size was a more variable index than group class frequency. Population density had some effect on mean group sizes, but the strength of the influence was quite weak, and only in cases where densities of two populations varied more than sevenfold did group sizes start to change. Group class frequency was not correlated with population density at all. The impact of the yearly breeding cycle on group size was bigger than population density.

The density-dependent response of goitered gazelle population was curvilinear in fashion, and it may be classified as intermediate between social-dwelling ungulate species, living in large groups and demonstrating continuous (linear) increases of group size with population density and those that are solitary or territorial ungulate species with no relationship between population size and group size, though the goitered gazelle population's weak response was distinctively closer to the one of solitary ungulate species.
Communicated by P. Acevedo

Population Status, Habitat Association, Feeding Behaviour and Diurnal Activity of Menelik's Bushbuck (*Tragelaphus scriptus meneliki)* in Dinsho, Bale Mountains National Park, Ethiopia.

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A Thesis Submitted to the Department of Zoological Sciences, College of Natural Sciences. Presented in Partial Fulfilment of the Requirements for the Degree of Master of Science, Addis Ababa University, Addis Ababa, Ethiopia
June, 2012

Abstract
Surveys on the population status, habitat association, feeding behaviour and diurnal activity of Menelik's bushbuck (*Tragelaphus scriptus meneliki*) were conducted in the Dinsho area of the Bale Mountains National Park from August 2011 to February 2012, including wet and dry seasons. Total count method and transect sampling method were used to determine the current population status, seasonal distribution, habitat association and sex and age structure. Direct observation on a focal animal group was carried out to study the feeding behaviour and activity patterns of the animal. "DISTANCE" software was used to estimate the total population. The estimated population of Menelik's bushbuck in the Gaysay-Adelay study area was 357 with a population density of 11.52 per km^2. The total population for the Headquarters was 28.5 with population density of 23.75 per km^2. The population was female biased with the ratio of 1.83:1.00 for Gaysay-Adelay study area and 2.75:1.00 for the Headquarters. Menelik's bushbucks were mostly observed as solitary, or in pairs. They were often associated with mountain nyala (15.17%) and warthog (9.8%) in forest woodland. They were observed consuming a total of 22 plant species of herbs and shrubs. *Geranium arabicum* was a highly preferred herb in the study area.

Morning and evening activity peaks were observed during both wet and dry seasons. High number of livestock and local people were observed cutting trees, to collect firewood inside the park. The study showed that the sex and age ratio of this species needs further investigation even if the population was not in immediate danger.

Variation of coat coloration between male and female Menelik's bushbuck in the study area (a) Male (b) Female (photos: © Martha Fischer/ Chris Gordon)

IUCN SSC Guiding Principles on Trophy Hunting as a Tool for Creating Conservation Incentives

Ver. 1.0 (09 August 2012)

Citation: IUCN SSC (2012). IUCN SSC Guiding principles on trophy hunting as a tool for creating conservation incentives. Ver. 1.0. IUCN, Gland.

Section I. Introduction

IUCN has long recognized that the wise and sustainable use of wildlife can be consistent with and contribute to conservation, because the social and economic benefits derived from use of species can provide incentives for people to conserve them and their habitats. This document builds on existing IUCN policies by setting forth SSC guiding principles on the use of "trophy hunting", as defined in Section II, as a tool for creating incentives for the conservation of species and their habitats and for the equitable sharing of the benefits of use of natural resources.

Trophy hunting is often a contentious activity, with people supporting or opposing it on a variety of biological, economic, ideological or cultural bases. This document is focused solely on the relevance of trophy hunting for conservation and associated local livelihoods. Nothing in this document is intended to support or condone trophy hunting activities that are unsustainable; adversely affect habitats; increase extinction risks; undermine the rights of local communities to manage, steward, and benefit from their wildlife resources; or foster corruption or poor governance.

Section II. Scope of this guidance

The term "trophy hunting" is here used to refer to hunting that is:

- Managed as part of a programme administered by a government, community-based organization, NGO, or other legitimate body;
- Characterized by hunters paying a high fee to hunt an animal with specific "trophy" characteristics (recognizing that hunters each have individual motivations);
- Characterized by low off-take volume;
- Usually (but not necessarily) undertaken by hunters from outside the local area (often from countries other than where the hunt occurs).

These elements differentiate the hunting at issue here from a broad array of other hunting activities, although it is recognized that what is here defined as trophy hunting may be given a different name in some countries. Thus these guiding principles are not intended to apply to subsistence hunting, to legal hunting of relatively common species, or to management activities undertaken by wildlife management agencies, although some elements of them may be relevant to these activities. Such hunting activities may also generate incentives for conservation, but are beyond the scope of this guidance.

These guiding principles apply specifically to trophy hunting programmes oriented to terrestrial wild animals in their native geographic ranges. Existing IUCN policy does not support moving species outside their native ranges for the primary purpose of trophy hunting1. In keeping with existing IUCN policy (IUCN Recommendation 3.093, adopted by the IUCN Congress at its 3rd Session in Bangkok, Thailand, 17-25 November 2004, which condemned "the killing of animals in enclosures or where they do not exist as free-ranging"), the IUCN SSC does not support trophy hunting of animals in enclosures where they cannot be considered "free-ranging" and cannot use their natural abilities to escape.

Section III: The policy context

IUCN's formal recognition that the ethical and sustainable use of wildlife can form an integral

[1] See: IUCN Position Statement on Translocation of Living Organisms (http://www.iucnsscrsg.org/download/IUCNPositionStatement.pdf) and IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species (http://intranet.iucn.org/webfiles/doc/SSC/SSCwebsite/Policy_statements/IUCN_Guidelines_for_the_Prevention_of_Biodiversity_Los s_caused_by_Alien_Invasive_Species.pdf)

and legitimate component of conservation programs dates back to the World Conservation Strategy in 1980, and was affirmed in Recommendation 18.24 at the 1990 IUCN General Assembly in Perth. IUCN's "Policy Statement on Sustainable Use of Wild Living Resources", adopted as Resolution 2.29 at the IUCN World Conservation Congress in Amman in October 2000, affirms that use of wildlife, if sustainable, can be consistent with and contribute to biodiversity conservation. IUCN recognizes that where an economic value can be attached to a wild living resource, perverse incentives removed, and costs and benefits internalized, favourable conditions can be created for investment in the conservation and the sustainable use of the resource, thus reducing the risk of resource degradation, depletion, and habitat conversion. In managing such use to enhance sustainability, the Policy Statement draws attention to the following key considerations:

• the need for adaptive management, incorporating monitoring and the ability to modify management to take account of risk and uncertainty;

• the supply of biological products and ecological services available for use is limited by intrinsic biological characteristics of both species and ecosystems, including productivity, resilience, and stability, which themselves are subject to extrinsic environmental change;

• institutional structures of management and control require both positive incentives and negative sanctions, good governance, and implementation at an appropriate scale. Such structures should include participation of relevant stake-holders and take account of land tenure, access rights, regulatory systems, traditional knowledge, and customary law.

More specifically, and with particular reference to southern Africa, IUCN has recognized that recreational hunting can contribute to biodiversity conservation. The IUCN at the 2004 WCC adopted Recommendation 3.093 stating that it "Supports the philosophy and practice that on state, communal and privately-owned land in southern Africa the sustainable and well-managed consumptive use of wildlife makes a contribution to biodiversity conservation" and further, that it "accepts that well-managed recreational hunting has a role in the managed sustainable consumptive use of wildlife populations".

Further, the IUCN SSC Caprinae Specialist Group adopted a formal position statement in December, 2000, recognizing that hunting, and in particular trophy hunting, can form a major component in conservation programmes for wild sheep and goats. This statement noted that "Trophy hunting usually generates substantial funds that could be used for conservation activities such as habitat protection, population monitoring, law enforcement, research, or management programs. Equally importantly, the revenues from trophy hunting can provide a strong incentive for conservation or habitat protection…"

The Convention on Biological Diversity has developed several statements of principles relevant for the management of trophy hunting. Most importantly, the 7th Conference of Parties to the CBD (Kuala Lumpur, February 2004) adopted the Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity (AAPG), and IUCN members party to the CBD were urged to honour these commitments by Resolution 3.074 of the 3rd IUCN World Conservation Congress (Bangkok, October 2004). The AAPG are based on the assumption that it is possible to use biodiversity in a manner in which ecological processes, species, and genetic variability remain above the thresholds needed for long term viability, and that all resource managers and users have the responsibility to ensure that such use does not exceed these. Some key relevant principles from the Addis Ababa Principles and Guidance include:

• Recognizing the need for a governing framework consistent with international/national laws, local users of biodiversity components should be sufficiently empowered and supported by rights to be responsible and accountable for use of the resources concerned (Principle 2);

• Adaptive management should be practiced, based on:

• o Science and traditional and local knowledge;

• o Iterative, timely and transparent feedback derived from monitoring the use, environmental and socio-economic impacts, and the status of the resource being used; and

• o Adjusting management based on timely feedback from the monitoring procedures (Principle 4)

• Sustainable use management goals and practices should avoid or minimize adverse impacts on ecosystem services, structure, and functions as well as other components of ecosystems (Principle 5);

• An interdisciplinary, participatory approach should be applied at the appropriate levels of management and governance related to the use (Principle 9);

• Users of biodiversity should seek to minimize waste and adverse environmental impact, and optimize benefits from uses (Principle 11); The costs of management and conservation of biological diversity should be internalized within the area of management and reflected in the distribution of the benefits from the use (Principle 13).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) provides for the authorization of trade of trophies in certain specimens of Appendix I-listed taxa for personal use (Res. Conf. 2.11 (rev. CoP 9). CITES has adopted a series of Resolutions for certain Appendix I-listed species subject to trophy hunting (Res. Conf 10.14 (rev. CoP 14) on Leopard *Panthera pardus*; Res. Conf 10.15 (rev. CoP 14) on Markhor *Capra falconeri;* and Res. Conf 13.5 (rev. CoP 14) on Black Rhinoceros *Diceros bicornis*), which set out quotas and conditions for such trade.

The European Charter on Hunting and Biodiversity (ECHB), adopted under the European Bern Convention, provides specific guidance on hunting and conservation. In Resolution 4.026, adopted at the 4th World Conservation Congress Barcelona, October 2008), IUCN requested that its members promote the ECHB in the implementation of IUCN's policies and Programme for 2009-2012. While the ECHB explicitly addresses sustainable hunting in Europe, its principles and guidelines are relevant and pertinent in a wider geographic context. Key principles of the ECHB include:

• ensuring that harvest is ecologically sustainable (Principle 3);

• maintaining wild populations of indigenous species with adaptive gene pools (Principle 4);

• maintaining environments that support healthy and robust populations of harvestable species (Principle 5);

• encouraging use to provide economic incentives for conservation (Principle 6); and • empowering local stakeholders and holding them accountable (Principle 9).

Section IV. Trophy hunting and conservation

Trophy hunting is a form of wildlife use that, when well managed, may assist in furthering conservation objectives by creating the revenue and economic incentives for the management and conservation of the target species and its habitat, as well as supporting local livelihoods. However, if poorly managed, it can fail to deliver these benefits. Although a wide variety of species (many of which are both common and secure) are hunted for trophies, some species

that are rare or threatened may be included in trophy hunting as part of site-specific conservation strategies. Examples include Cheetah *Acinonyx jubatus* and Black Rhinoceros in southern Africa, and Straight-Horned Markhor *Capra falconeri megaceros* in the Torghar Valley of Pakistan, all of which are species listed on Appendix I of CITES.

Trophy hunting takes place in both North America and Europe, and in developing countries where wildlife management infrastructure is often less fully developed. These hunts are usually conducted by persons willing and able to pay substantial amounts of money for the opportunity. They typically involve taking small numbers of individual animals and require limited development infrastructure.

They are thus high in value but low in impact. In some cases, trophy hunting forms an important component of Community-Based Conservation/Community-Based Natural Resource Management, which aim to devolve responsibility for the sustainable use and management of wildlife resources from distant bureaucracies to more local levels.

Understanding the context within which trophy hunting occurs is critical to understanding its potential to benefit conservation. In many parts of the world, much wildlife exists outside of protected areas. Wildlife shares landscapes with people, and typically competes for space and environmental resources with other forms of economically productive land uses, such as agriculture and pastoralism, upon which the livelihoods of local people depend. Wildlife can impose serious costs on local people, including physical harm, damaging crops, and competing with livestock for forage. Where wildlife provides few benefits to local people and/or imposes substantial costs, it is often killed (legally or illegally) for food, various commercially valuable wildlife products, or as problem animals, and its habitats are degraded or lost to other forms of land use. In some circumstances trophy hunting can address this problem by effectively making wildlife more valuable than, and/or complementary to, other forms of land use. It can return benefits to local people (preferably through effective co-management), encouraging their support for wildlife, and motivating investment at community, private, and government levels for research, monitoring, habitat protection, and enforcement against illegal use (see Annex 1 for examples). Trophy hunting, if well managed, is often a higher value, lower impact land use than alternatives such as agriculture or tourism.

However, where poorly managed, trophy hunting can have negative ecological impacts including altered age/sex structures, social disruption, deleterious genetic effects, and in extreme cases, population declines. It can also be difficult to ensure that benefits from hunting accrue to those in the best position to help conservation.

Section V: The Guiding Principles

The IUCN SSC considers that trophy hunting, as described in Section II above, is likely to contribute to conservation and to the equitable sharing of the benefits of use of natural resources when programmes incorporate the following five components: Biological Sustainability; Net Conservation Benefit; Socio-Economic-Cultural Benefit; Adaptive Management: Planning, Monitoring, and Reporting; and Accountable and Effective Governance

Biological Sustainability

Trophy hunting as described in Section II, can serve as a conservation tool when it:

1. Does not contribute to long-term population declines of the hunted species or of other species sharing its habitat, noting that a sustainably harvested population may be smaller than an unharvested one;
2. Does not substantially alter processes of natural selection and ecosystem function; that is, it maintains "wild populations of indigenous species with adaptive gene pools.[2]" This generally requires that hunting offtake produces only minor alterations to naturally occurring demographic structure. It also requires avoidance of breeding or culling to deliberately enhance population-genetic characteristics of species subject to hunting that are inconsistent with natural selection;
3. Does not inadvertently facilitate poaching or illegal trade of wildlife;
4. Does not artificially and/or substantially manipulate ecosystems or their component elements in ways that are incompatible with the objective of supporting the full range of native biodiversity.

[2] *Direct quote from principle 4 of the European Charter on Hunting and Biodiversity.*

Net Conservation Benefit

Trophy hunting can serve as a conservation tool when it:

1. Is linked to identifiable and specific parcels of land where habitat for wildlife is a priority (albeit not necessarily the sole priority or only legitimate use); and on which the "costs of management and conservation of biological diversity [are] internalized within the area of management and reflected in the distribution of the benefits from the use"[3];
2. Produces income, employment, and/or other benefits that generate incentives for reduction in pressures on populations of target species, and/or help justify retention, enhancement, or rehabilitation of habitats in which native biodiversity is prioritized. Benefits may create incentives for local residents to co-exist with such problematic species as large carnivores, herbivores competing for grazing, or animals considered to be dangerous or a threat to the welfare of humans and their personal property;
3. Is part of a legally recognized governance system that supports conservation adequately and of a system of implementation and enforcement capable of achieving these governance objectives.

Socio-Economic-Cultural Benefit

Trophy hunting can serve as a conservation tool when it:

1. Respects local cultural values and practices (where "local" is defined as sharing living space with the focal wildlife species), and is accepted by (and preferably, co-managed and actively supported by) most members of the local community on whose land it occurs;
2. Involves and benefits local residents in an equitable manner, and in ways that meet their priorities;
3. Adopts business practices that promote long-term economic sustainability.

Adaptive Management: Planning, Monitoring, and Reporting
Trophy hunting can serve as a conservation tool when it:
1 Is premised on appropriate resource assessments and/or monitoring of hunting indices, upon which specific quotas and hunting plans can be established through a collaborative process. Optimally, such a process should (where relevant) include local communities and draw on local/indigenous knowledge. Such resource assessments (examples might include counts or indices of population performance such as sighting frequencies, spoor counts) or hunting indices (examples might include trophy size, animal age, hunting success rates and catch per hunting effort) are objective, well documented, and use the best science and technology feasible and appropriate given the circumstances and available resources;
2 Involves adaptive management of hunting quotas and plans in line with results of resource assessments and/or monitoring of indices, ensuring quotas are adjusted in line with changes in the resource base (caused by ecological changes, weather patterns, or anthropogenic impacts, including hunting offtake);
3 Is based on laws, regulations, and quotas (preferably established with local input) that are transparent and clear, and are periodically reviewed and updated;
4 Monitors hunting activities to verify that quotas and sex/age restrictions of harvested animals are being met;
5 Produces reliable and periodic documentation of its biological sustainability and conservation benefits (if this is not already produced by existing reporting mechanisms).

Accountable and Effective Governance
A trophy hunting programme can serve as a conservation tool when it:
1 Is subject to a governance structure that clearly allocates management responsibilities;
2 Accounts for revenues in a transparent manner and distributes net revenues to conservation and community beneficiaries according to properly agreed decisions;
3 Takes all necessary steps to eliminate corruption; and
4 Ensures compliance with all relevant national and international requirements and regulations by relevant bodies such as administrators, regulators and hunters.

Section VI: Appropriate use of these guiding principles
SSC's intention is that these guiding principles may serve to assist authorities responsible for national and subnational policy, law and planning; managers responsible at the site level; and local communities in designing and implementing trophy hunting programs where biodiversity conservation and equitable sharing of natural resources are objectives.

These guiding principles should not be interpreted as in any way dismissing the values - whether they are biological, social, cultural or economic - of hunting programs that may be truly sustainable, but that do not produce incentives for conservation and associated conservation benefits.

Although IUCN and SSC are not currently engaged in endorsing or certifying trophy hunting programmes, they consider that for any such endorsement or certification to be credible, it should be conducted by a recognized independent body. Nothing in this document is intended to be interpreted in any way as a specific endorsement or criticism of a particular trophy hunting programme.

Annex 1. Examples of trophy hunting as part of a conservation strategy
Note: Due to the varied potential conservation impacts of trophy hunting it is useful to provide a small set of illustrative case studies highlighting both positive and negative conservation impacts. We have here included two illustrations of generally positive conservation impacts. We would welcome suggestions for further examples, both positive and negative, noting that in the case of negative examples we are sensitive to not casting blame or criticizing member groups and member states.

Case study 1: Trophy hunting in Namibian communal Conservancies
Namibia's communal Conservancy programme is widely viewed as a conservation and rural development success story, and trophy hunting plays a central role in this success. Innovative legislative reforms in the mid-1990s devolved conditional rights to use and manage wildlife on communal lands to communities, if they organized to form a Conservancy. The intent of this approach was to devolve rights and benefits from wildlife to communities – people often viewed by colonial conservationists as "poachers" - to create incentives for communities to live with, value, and benefit from wildlife. Forming a Conservancy requires that the community defines its membership, borders, and management committee; develops a Constitution; agrees a method for equitable distribution of benefits; and develops a sustainable game management and utilization plan. Conservancies can use wildlife consumptively in various ways, including trophy hunting, own-use hunting game cropping, and live sales; and organize nonconsumptive use through tourism. Conservancies retain all the revenue gained from utilization and management.

The spread of the conservancy movement has been rapid, and conservation impacts extensive and widespread. Today there are 71 registered communal Conservancies covering 14.98 million ha (with another 20 conservancies under development) and include around 240 000 members. Current communal Conservancies alone mean that 18.2% of Namibia's land surface is under conservation management. This is a contrast from the previous status of these areas as subject to long-term human-wildlife conflict, uncontrolled poaching, and low levels of wildlife.

Sustainable use of wildlife has been a strong catalyst to the recovery of wildlife in communal areas. Prior to the introduction of conservancies, wildlife in Namibia's communal areas had been decimated and was at historic lows in many instances. Wildlife was perceived by communities mainly as a threat to livelihoods, with its best use being illegal poaching for meat for the pot. The advent of Conservancies drastically altered this attitude. Wildlife is now increasingly seen as a valued asset, with growing wildlife populations meaning more income for conservancies, more jobs for conservancy members, more game meat at the household level, and more funds to support rural development. As a result, poaching

has become socially unacceptable and game numbers have staged remarkable recoveries in most areas where Conservancies have operated for a period of time. For instance, on communal lands in northeast Namibia, from 1994 to 2011, elephant have increased from 12,908 to an estimated 16,993; sable from 724 to an estimated 1,474; and common impala from 439 to 9,374. In northwest Namibia4, from the early 1980s to today, desert elephants have increased from approx. 150 to approx. 750; Hartmann's Mountain Zebra from est. <1,000 to > 27,000; and black rhino have more than tripled, making it the biggest free-roaming population of rhino in the world. From 1995, the population of lion in this area has increased from an est. 20 to an est. 130, with exponential range expansion. Game populations have been re-established in Conservancies that have low densities of specific species or species that have gone locally extinct. This support has allowed for the re¬establishment of a large number of species, including giraffe, red hartebeest, black faced impala and black rhino. Further, Conservancies, a large proportion of which are located adjacent or close to protected areas,

[4] *Game guard programs, precursors of the current model, were introduced in this area in the early 1980s.*

strengthen Namibia's protected area system by ensuring wildlife friendly environments adjacent to protected areas and through the creation of movement corridors between them.

Trophy hunting has been a central driver of this transformation. It is by far the largest generator of benefits from sustainable consumptive wildlife use, with 41 Conservancies hosting 40 trophy hunting concessions during 2011.

Since registration of the first four communal conservancies in 1998, a total of 97 948 km2 have been opened to trophy hunting concessions under community management. Benefits from consumptive use of wildlife (cash, employment, and in-kind [largely meat]) received by Conservancies and their members from 1998-2009 amounted to N$76.5 million (US$10.17 million) (NACSO Database, 2011). As the benefits from consumptive use have driven recovery of wildlife populations through reduction of poaching, these recoveries have in turn paved the way for non-consumptive tourism, more than doubling the returns from wildlife to communities. In 2011 more than 30 joint venture tourism lodges and 24 community campsites were functioning in communal Conservancies, generating Conservancy benefits (including cash, employment and in-kind benefits) of N$102.8 million (US$13.64 million) from 1998-2009. Tourism enterprises have proven to be strong, complementary additions to consumptive use options, with consumptive use (primarily trophy hunting) generating the majority of cash income to Conservancies (which can be put toward wildlife management activities and community development purposes), and tourism operations providing the greater individual employment benefits to Conservancy members. Benefits from consumptive use are critical because these can start to flow when wildlife populations are initially too low to support tourism, stimulating recoveries of wildlife to levels at which photographic tourism can become viable.

Community development activities paid for by benefit streams from sustainable use, among others, include improvements to schools or school facilities and equipment; improvements to rural health clinics; support to pensioners; scholarship funds; transport for the sick or injured; mitigation of human / wildlife conflict; and sponsoring of community sports teams. Finally, the hunting operations provide meat to community members (many very marginalized): meat provided from trophy hunting and own-use harvesting was valued at N$17,413,120 (US$2.29 million) between 1998 and 20095 (NACSO, 2010).

A number of cutting edge tools and practices have been developed by the Namibia CBNRM Programme to ensure sustainable hunting is playing a key conservation role, including:

• annual quota setting procedures for sustainable harvest offtake rates: jointly carried out by the MET, NGOs, and the Conservancies, and based upon annual game counts, hunting operator reports, and local knowledge of conservancy/MET/NGO staff;

• trophy hunting tender procedures for Conservancy hunting concessions: these aim to attain market values for game in a transparent manner, and strengthen relationships between the Conservancy committee and the hunting operator;

• trophy hunting contracts: through the Conservancy movement communities have been empowered to become meaningful partners in the development and support of hunting activities, although many remain on a steep learning curve; and

• Conservancy management plans and practices: funds generated from wildlife use are used by conservancies to employ community game guards and implement game management and monitoring systems, allowing communities to proactively counter poaching threats and mitigate increasing incidents of human/wildlife conflict.

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[5] The value of distributed meat is calculated by using market values and average meat yields of game animals from which the meat was distributed, as recorded by conservancies in the Event Book.

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Case study 2: Conservation and trophy hunting in the Torghar Valley, Pakistan

Torghar (black mountains/hills in Pushtoo) is in the province of Balochistan in Pakistan. In the early 1980s, wild Straight-horned

Markhor *Capra falconeri megaceros* and Afghan Urial *Ovis orientalis* were close to being extirpated from this region due to uncontrolled hunting and competition for grazing with domestic herds. Enforcement efforts against hunting were poor due to weak institutional capacity and lack of political will. In the mid-1980s, a tribal decree banning hunting was issued by a local leader, but could not be enforced. Local Jazalai (a Pathan tribe) leaders, with support from the United States Fish and Wildlife Service (USFWS), launched a community-based conservation programme in 1986, the Torghar Conservation Project (later managed by STEP, the Society for Torghar Environmental Protection). This project used limited and monitored trophy hunting, initially of Urial only and later also of Markhor, to provide revenue to fund the employment of local people as game guards and to provide community benefits. The hypothesis was that development of local livelihoods based on trophy hunting would change the attitude of local people toward wildlife, demonstrating that conservation could be an economically viable land use, and providing incentives for enforcement. In line with its commitment to conservation, the trophy hunting has been conservative, with 1-2 Markhor and 1¬4 Urial taken per year.

After careful consideration, tribesmen accepted a ban on their traditional hunting in return for the economic benefits of the conservation programme. Illegal hunting virtually ceased. While exact population numbers cannot be ascertained in the difficult terrain, use of repeated standardized survey protocols have found that the Torghar populations of Markhor and Urial have steadily increased since the project started. Surveys at Torghar by USFWS-sponsored biologists found the estimated population of Markhor grew from less than 100 in 1990 to 2,541 in 2005, with estimated Urial populations increasing from 1173 in 1994 to 3,146 in 2005.

Over this period, the programme has continually faced a lack of regulatory support, including government reluctance to recognize local involvement in conservation, bans on hunting imposed by the national Conservation Council, and the listing of Markhor on Appendix I of CITES, making export of trophies to major market countries such as the United States problematic. Despite these obstacles the programme has grown, attracting further support from the United Nations Development Programme, WWF-Pakistan, the Global Environment Facility and others. While other means of raising revenue such as ecotourism based on photography have been considered, the region is remote and attracts few visitors.

TCP/STEP has also generated considerable benefits for the approx. 400 families of the local area. Revenues raised by trophy hunting and donor grants pay salaries for ca. 82 game guards, and have been used for community needs such as construction of water tanks, dams and irrigation channels (to provide water during droughts), supply of young fruit trees, a medical camp and emergency drought relief.

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