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Antelope Specialist Group

GNUSLETTER

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FROM THE EDITOR...

Readers and subscribers of the Antelope Specialist Group (ASG) **GNUSLETTER** appreciate the interesting reports and news of antelope research and conservation projects around the world. We have come to depend on this publication to keep abreast of antelope issues and the activities of people working for antelope. To many of us, **GNUSLETTER** represents a critical information resource, in an arena that has not historically received much attention outside this circle.

Dependability and quality. How can one briefly describe twenty seven years of effort by Dick Estes, as Chair of the Antelope Specialist Group and **GNUSLETTER** editor? Certainly as an incredible accomplishment that cannot be justified in a single paragraph. Never the less, Dick has made this periodical the credible document we know today. I would be remiss not to mention Runi Estes, Dick's wife who has edited and published the **GNUSLETTER** for the ASG since its inception, and as Dick relates, has been the brains and brawn behind the production. Thank you to Dick and Runi for your untiring efforts for the **GNUSLETTER** and antelope.

News services around the globe recently picked up the story of the impressive antelope migration survey in Sudan. Though antelope folk have known of the scale of these populations for years (see Heckel this issue), what a refreshing and positive report to relate to the world amid the ever-depressing environmental news!

ASG member Paul Elkan and investigators have done an excellent job of spreading the antelope gospel. Working together, through **GNUSLETTER** and other mediums, perhaps we might build on this momentum, and keep critical antelope issues on the forefront of world conservation news. Your opinions, reports, and ideas are valuable to this effort.

With the leadership of the ASG Co-Chairs Chardonnet and Mallon, and your work, the dedicated ASG members, there is much in the world of antelope worthy of reporting. I look forward to working with you in keeping the **GNUSLETTER** as an important antelope conservation and information resource.

From the ASG Chairs

Dear ASG members,

"Too much talk & too little action" is commonly reported in our world. The opposite seems to apply to the Antelope Specialists Group: a lot of action but not much talking. We freely admit to a lack of communication and are working on ways to improve this in the future. ASG is mainly made up of very active members with strong personal involvement in field activities which is detrimental to allocating much time to administrative work. It is difficult to include in the present issue of **GNUSLETTER** the whole range of recent and current ASG activities. Many members and groups are active in the field but simply do not publicise their work proactively. We should make efforts to develop that side of our work.

We give an overview here of some of the main issues we have recently been involved with. However, first we should pay tribute to what has been done in the former trienniums. Two major events in the life of ASG recently occurred. The tragic early loss of Rod East reminded us of his immense accomplishment in producing the African Antelope Database and the Antelope Action Plans and the daunting task facing us of continuing this work. And with the departure of Dick Estes we realize that we are taking over from someone whose great dedication and vast global knowledge of antelopes were placed at the service of ASG over a period of 25 years.

At the same time we welcome Steve Shurter as the new editor of **GNUSLETTER.** Steve has extensive expertise and experience, both in field and ex-situ conservation. We are immensely grateful to him for taking on this task and on behalf of ASG wish him every success.

Our main activities have included:

•Reorganisation of the group

It has taken longer than expected to reorganise ASG (and some members still have not returned their contact details).

•ASG is presently made up of 91 members from 35 countries.

•There are 5 Regional Coordinators: Urbain Belemsobgo and Geoffroy Mauvais for West and Central Africa, Chris Thouless for East Africa, Jens-Ove Heckel for North-East Africa, Petri Viljoen for Southern Africa

•In order to facilitate administration of ASG activities, we have identified a small Core Group which is currently made up of:

•The 2 Co-Chairs
•the former Chair, Dick Estes
•the Regional Coordinators
•the editor of Gnusletter, Steve Shurter

•Red List and Global Mammal Assessment

As you all know, the Red List (RL) is a major asset and instrument of IUCN and maintaining updated assessments it is one of the formal obligations of all Specialist Groups. Red List assessments have now been combined with those for the Global Mammal Assessment (GMA). A lot of antelope taxa have reached the 10 year deadline where the RL status becomes effectively obsolete. Consequently, we are engaged in the process of reviewing all antelope taxa. 12 species from North-east and North Africa were re-assessed and updated for the 2007 RL and we plan to complete the whole set of antelope taxa by the end of the year. David Mallon is the official RL Focal Point for ASG and is leading this process. He is assisted by Mike Hoffmann from IUCN's GMA unit and others acting as either assessors or evaluators.

•Advice and comments to CITES, CMS, SSC, IUCN, other agencies and people in response to requests.

•Publications

•We intend to continue the series of Antelope Survey Updates, as funding allows. Jens-Ove Heckel and the North-East Africa sub-group have already embarked on an update for NE Africa.

•Prospects and future planning

•To hold a Core Group meeting

•To finalize the RL/GMA process and identify priorities among threatened antelopes

•To begin updating the Antelope Country Profiles which have been completed in the 4 parts of the Antelope Action Plans

•To develop a comprehensive ASG website.

•To consider a meeting of ASG members associated with the World Conservation Congress in Barcelona, Spain in September 2008

Please do not spare efforts to communicate within our group and do not hesitate to contact your Regional Coordinator and/or the Co-Chairs.

All the best!

Philippe Chardonnet & David Mallon

ASG News

Population Estimates of Mountain Nyala on the Rise

by Paul Evangelista

The mountain nyala *(Tragelaphus buxtoni)* is endemic to the highlands of Ethiopia and only known to inhabit the eastern side of the Rift Valley. First reported in 1908 by Major Ivor Buxton, the mountain nyala is considered to be the last large ungulate species discovered in Africa. Nearly a century after it's discov-ery, scientists still know very little about the population or distri-bution of the species, which at times has impaired management and conservation strategies.

The first significant surveys of the mountain nyala were conducted by Leslie Brown in the late 1960s. Brown was the first to attempt to define the mountain nyala's full range, and determine population densities at both local and regional scales. In 1969, he reported that the total population of mountain nyala was probably between 7,000 and 8,000, not likely to be less than 4,500, and as high as 12,500 at best. As a result of Brown's report, the mountain nyala was taken off IUCN's Red List of Endangered Species from 1969-1974, for the first and only time since it was first listed in 1945.

The next significant population estimate was conducted by Chris Hillman in 1988. Hillman's work, largely conducted in the Bale Mountains National Park (BMNP), suggested that mountain nyala populations totaled between 2,000 and 4,000. Since then, population estimates have continuously declined with some recent estimates suggesting populations as low 1,000 with 95% of these residing within the BMNP. Once again, there is new inter-est and concern over the status of the mountain nyala, and both Ethiopian wildlife managers and international conservation groups are actively seeking accurate population estimates to facilitate proper management initiatives and insure the long-term survival of the species.

Mountain nyala populations are fragmented throughout Ethiopia, and in many cases isolated to mountain peaks or rugged terrain that deter human encroachment. The most northern populations of mountain nyala are found in the Chercher Moun-tains, also called the Ahmar Mountains, specifically in the Kuni-Muktar Wildlife Sanctuary, and in Din Din and Arba Gugu Controlled Hunting Areas.

In 1998, the mountain nyala was thought to be extinct from Kuni-Muktar which fueled the concern that the species was declining to dangerously low numbers. This was not the case however, and in 2003 the Ethiopian Wildlife Conservation Department (EWCD) confirmed their persistence, suggesting that the Kuni-Muktar population is around 200. I visited the area in 2005 and found that local communities and wildlife man-agers have been proactive in maintaining the sanctuary, and were engaged in an extensive reforestation campaign. The most recent surveys of Kuni-Muktar, Din Din and Arba Gugu would put the total population of mountain nyala in the northern range at about 350.

The central Southern Highlands are dominated by the Arussi Mountains, and are also known to have only a few remnant mountain nyala populations. The best known area is the Galama Mountains, which was made famous by early safari hunters and explorers such as Major Buxton, Gertrude Sanford, Sidney Legendre, and James Mellon. I participated in a landscape assessment of the Galama Mountains in 2001, and was disappointed to find the area heavily degraded by annual burning, soil erosion, and large numbers of livestock. Mountain nyala populations and critical habitat in the Galama Mountains were decimated by civil unrest following the collapse of the Derg government in 1991, and have never fully recovered. Using three game scouts to survey Galama Mountains for a ten week period, we estimated mountain nyala to number about 100.

West of the Galama Mountains is the Munessa-Shashamane State Forest, which is intensively managed for sustainable and multiple-use of natural resources. Mountain nyala populations here were also impacted by the change of government in the early 1990s, but made a rapid recovery. The forests are a mix of old-growth native trees and plantation style timber production that is well protected from communal exploitation. Recent surveys of Munessa by EWCD and the Oromyia Regional Government (ORLNRAD) estimate the numbers in this forest to be around 330. Other areas in the Arussi Mountains that are known to have smaller populations of mountain nyala, mostly limited by available habitat, include Mt. Kaka, Gambo State Forest, and possibly Mt. Kubsa. These areas have not been recently surveyed to my knowledge.

The most southern range of mountain nyala are in the Bale Mountains, most commonly reported in the northern parts of BMNP near the town of Dinsho, the Park Headquarters, and Hanto Controlled Hunting Area, sometimes called Lajo-Spur. BMNP was established in the early 1970s primarily to protect mountain nyala and Ethiopian wolf populations. Areas near Dinsho and the Park Headquarters were surveyed in 2003 by Befekadu Refera, a student from Addis Ababa University. Using direct counts, Refera's highest count for mountain nyala was 732, while the adjacent Hanto area was estimated to have 375 by EWCD and ORLNRAD. Historical accounts indicate that mountain nyala populations were more prevalent in the upper Web Valley and Senetti Plateau. These areas still have mountain nyala populations, but densities have thinned as a result of human settlements and livestock grazing. I have been unable to find any survey data for either of these areas. The southern portion of the BMNP is covered by the Harenna Forests where several previous reports suggest that mountain nyala are absent and have never inhabited the area. In 2000 and 2001, new mountain nyala populations were discovered on the eastern escarpment of the Bale Mountains, but remain largely overlooked by many recent population estimates. However, EWCD and ORLNRAD have established three Controlled Hunting Areas, Odo Bulu, Abashabe-Demero, and Shedem Berbere, and have conducted multiple surveys in these areas since 2000. Combined, the most recent surveys on the eastern escarpment put populations over 1,200 animals without taking in consideration large tracts of forests outside the hunting areas.

Not including Mt. Kaka, Mt. Kubsa, Gambo State Forest, Senetti Plateau, and the upper Web Valley, the most recent population surveys total over 3,100 mountain nyala. This information was not difficult to find; yet too often, population esti-mates tend to overlook some of these areas or fail to thoroughly investigate an area. Throughout my investigation of mountain nyala populations, I have found that the most conclusive estimates have been conducted by the EWCD and ORLNRAD. Unfortunately, these agencies are rarely acknowledged for their work or results by non-Ethiopian researchers. EWCD and ORLNRAD not only employ common scientific methods in their surveys for example transects and direct counts, but also does so on a temporal basis over the majority of the mountain nyala's known range. Outside of BMNP, there have been few surveys conducted that incorporate scientific methodology other than those by Ethiopian wildlife

officials and Leslie Brown. This should raise questions as to how and why recent population estimates published in scientific papers and reports continuously hover between 1,000 and 2,000 mountain nyala.

The simple calculations I present still do not accurately reflect the true population of mountain nyala. There have been several significant discoveries of new mountain nyala populations within the last two years. The first discovery was made in an area between the Galama Mountains and Arba Gugu. Recent surveys by Ethiopian wildlife officials estimate a population of about 350. This is an unusual case, since this region of Ethiopia is heavily settled by people and much of the surrounding land has been cultivated or logged. A new Controlled Hunting Area has recently been established in an effort to curb further degradation of the landscape.

In the Bale Mountains, EWCD and ORLNRAD have been investigating the remote highlands south of the Dodolla (west of BMNP). There have always been scattered reports from local people of mountain nyala inhabiting the area, but most have discounted any significant numbers due to the high number of people, forestry activities, and the sparse vegetation on the dryer northern slopes. The interior of the highland forests are contrastingly different with more mesic vegetation and rugged terrain which has isolated the area from people and livestock. Surveys have not yet been conducted, but analyses of satellite images indicate that ideal mountain nyala habitat could exceed 800 km2.

Similar circumstances occur in the Harenna Forest and Mena-Angetu Forest Priority Area on the southern escarpment of the Bale Mountains.These largely intact forests stretch from the town of Rira west to Riripa and Goma. I visited the area earlier this year and estimate that mountain nyala habitat may span as much as 3,000 km2. The total forested area is actually much larger, but drops to elevations that are not as favorable to mountain nyala. The area is continuous with minimal fragmentation from human settlements or land-use. Rugged terrain and deeply incised valleys prohibits human accessibility to the vast majority of the landscape, while creating optimal habitat for mountain nyala. At this point, it would be nearly impossible to estimate how many mountain nyala can be found here, but Ethiopian wildlife officials are actively surveying the area and a new Controlled Hunting Area is scheduled to open in 2007.

Due to uncertainty of the specie's entire range and inconclusive results from population surveys, the total number of mountain nyala cannot be accurately reported at this time. However, evidence clearly indicates that populations exceed estimates reported in recent literature. Despite all the controversy surrounding the status of mountain nyala, credit needs to be given to the work conducted by EWCD and ORLNRAD for their systematic approach of monitoring regional populations, development of intensive management and conservation strategies, and for not succumbing to the pressures that result from low speculative population estimates. Today, Controlled Hunting Areas are well managed with habitat destruction being controlled in most cases, local communities and regional governments receiving economic benefits from hunting revenues, and professional hunters having long-term conservation incentives. But most im-portantly, mountain nyala populations are largely stable, and in some cases, on the rise. Hunter success rates in 2004/2005 were an impressive 97.6% and trophy sizes are at an all time high with five mountain nyala expected to rank in the SCI top 15 from this past year alone, each sporting horns greater than 38". Wildlife management in Ethiopia still has room for improvement and faces many challenges, however, the current system is a model built on sustainability, conservation, and the distribution of benefits that many African countries could consider following.

The previous article appeared in the African Indaba eNewsletter Volume. 4, Number 5

MELCA Mahiber Cultural Biodiversity and "Mountain Nyala Day" Report December 23rd-24th 2006

by Befekadu Refera, MELCA Mahiber Program Coordinator

MELCA has organized a two day cultural biodiversity celebration and Mountain Nyala Day on 23-24 December 2006, in partnership with Saint Louis Zoo, The Gaia Foundation, Frankfurt Zoological Society, Arsi Bale Rural Development Project (ABRDP) and the Bale Mountains National Park. It was held at Bale Zone Dinsho town. The key participants of the celebration were seven primary and secondary schools from Menagesha Suba and Sebeta (Central Ethiopia) areas and nine schools from Dinsho (around Bale Mountains National park HQ) areas. All the schools had participated in Social Empowerment through Group Nature and Interaction (SEGNI) program. "Segni" in local Oromo language means "seed". For further information about SEGNI, we will send the brochure of SEGNI, MELCA and the Brochure that are prepared for "Mountain Nyala Day" (all the three versions "Amharic, English and Afan Oromo") as well as the CD that holds beautiful pictures of the ceremony.

School teachers, elders, youth groups, governmental officials and the local people around Dinsho town had participated on the celebration. The total number of the participants of the celebration is estimated to be more than 2,500.

The major objectives of the celebration were:

• To appreciate the value of cultural biodiversity (CB) for both cultural recuperation and biodiversity conservation.

• To let the students and teachers from Bale and central Ethiopia get a chance to interact with CB implementer in their respective places and learn first hand how and why CB is implemented.

• To celebrate the endemic "Mountain Nyala Day" and use the mountain nyala as a flagship species to conserve the biodiversity in which both the mountain nyala and the local community depends on.

• To educate and get the support of decision makers for CB work and show the value of working with elders and to explore the knowledge and skills of elders about Oromo culture and biodiversity.

• To show SEGNI program is an integral part of the CB process.

Major programs

1. Exhibition

The students organized a cultural biodiversity (CB) exhibition which includes collected plants and animals specimens, cultural dressings, local food items, collection of seeds, cultural artifacts, etc.

2. Music, Drama, poem and speeches

Drama and poems on mountain nyala and traditional music has been presented to the audience by the nine schools from Bale and seven schools from central Ethiopia. Students came with their bonnets (that represent the horns of mountain nyala) byconsidering mountain nyala as a flagship species

and representing the conservation of biodiversity and the traditional clothes that depict the relationship between culture and biodiversity and the importance of conserving them.

All the presented songs, dramas, poems, exhibition and music were focused on the importance of conservation of natural resources, conserving their culture and traditional ecological knowledge of elders and the importance of the need of filling the inter-generational gap between young generation and elders. The celebration was decorated with mountain nyala photos, drawings, paintings, and sculpture (made of sheep hide).

In relation to the CB-celebration and Mountain Nyala Day, the local community participants were given a chance to express their feelings about the Bale Mountains National Park and their relation with the park administration as well as with MELCA's project. Their response was fantastic. Especially, their explanation about MELCA and their involvement in planting tree seedlings inside the community forest and soil and water conservation work along the park boundary was very interesting and great encouragement for MELCA's future work.

3. Visit of the nursery site

MELCA has started a nursery site with a total area of 11,205.75m2. So far a total seedling of 219,173 of Juniperus procera and Hagenia abyssinica (both are indigenous tree seedlings) are raised. The nursery site has also been visited by the participants of the celebration. The Bale Mountains MELCA's Project coordinator has given enough explanation about the tree nursery site and its management. The tree seedlings are in good germinating condition. Next to this, Mr. Million, Director of MELCA has also explained the future plan of MELCA in expanding the nursery site capacity both in number and variety that includes more indigenous tree and highland fruit seedlings as well as how this activity is directly related with the community and conservation of the natural resource of the park.

4. Trip to the Sanetti

On December 24th, 2006 MELCA had organized a field visit for students and teachers of the Menagesha Suba to Sanetti Plateau. This plateau is part of the Bale Mountains National Park, and its altitude reach up to 4,377 above sea level. It is a place where the endemic Ethiopian wolf, giant mole rat and a plant called GiantLobelias are found. The Giant Lobelia grows up to 7 meters. The plateau is also "the water tower" for South East Ethiopia and Somalia. All over the plateau, finding small bogs and lakes is common. The participants have also visited the cloud forest of Rira. In general, the participants have got a chance to visit the beautiful scenery and the genetic reservoir of the park.

Next to this, they have returned and visited the Gaysay grassland a place where the 75% of the global mountain nyala population found. At this juncture, detail explanation of the park and how this visiting is related to the cultural biodiversity and Mountain Nyala Day. Furthermore, it was explained how schools can jointly work with the park and community in conservation of the natural resources. Finally, the two days activities were evaluated by students and schools.

At the conclusion, the Bale Beauty Nature club (BBNC) gave a gift of "Mountain Nyala statue" made of recycled paper, T-Shirts that is made by the club and paint of Mountain Nyala to MELCA. With that the two days of celebration concluded by closing remark of Mr. Million, MELCA's Director.

Activity and Budget Utilization Report for SAINT LOUIS ZOO

"Environmental Education for the Conservation of Mountain Nyala and Its Habitat at the Bale Mountains National Park, Ethiopia"

Provided by St. Louis Zoo Wild Care Institute

BACKGROUND

MELCA (Movement for Ecological Learning and Community Action) was registered in 2004 with the Federal Ministry of Justice as a membership based association. MELCA has 154 members of which 39% are women. It is a broad membership base comprising farmers, foresters, lawyers, ecologists, sociologists, environmentalists, youth network and women's associations.

MELCA, in its objective of contributing to the intergenerational transfer of traditional ecological knowledge, reduce the degradation of the environment and culture, have introduced a programme called "SEGNI". This programme is an innovative way for linking elders and youth at the Bale Mountains National Park. To meet its objective, MELCA with collaboration of Saint Louis Zoo and some other partners have performed the following activities in Bale Mountains National Park in 2006-2007.

1. SEGNI (Social Empowerment through Group and Nature Interaction)

SEGNI in one of Ethiopian language, Oromiffa, means "Seed". It is also an abbreviation for Social Empowerment through Group and Nature Interaction (SEGNI). The SEGNI program takes youth into the wilderness, "on trail", to experience nature, learn about traditional knowledge of biodiversity and conservation, and foster leadership. The wilderness trails provided by the program involve five-night wilderness treks in national parks and forests under the tutelage of elders. It is an innovative approach to experiential learning about environment and culture. There are currently no other educational initiatives in Ethiopia that are known to include all the key elements of SEGNI i.e. awareness creation of ecological issues, experiential learning in an environmental setting, learning from elders about traditional knowledge systems, practical application through youth-led local project development, individual personal development and development of empowerment projects in the greater community responding to local needs and input led by the youth themselves.

In 2006, seven SEGNI programs were carried out at the Bale Mountains

National Park. In total, 112 individualsparticipated and almost half of them were girls. This included college and university students.

Objectives

• To provide a genuine experience on nature and culture for children and youth who will be the future agents in environmental thinking and action.

• To influence the formal education system towards experiential student centered action learning and teaching which incorporates traditional ecological knowledge.

• To give a deeper experience on nature and on the value of the Bale Mountains National Park to decision makers and media to make them active supporters of conservation.

1.1 Orientation

Initially, before all activities of SEGNI are started in the school, a general orientation about the programme for school students, teachers, school directors and different school club leaders is given. Next to this general orientation, a detailed orientation of the programme is also given to the selected participants of the programme. This orientation includes the "do's and not do's" of the programme and a detailed explanation about the content of the programme.

1.2 Generic characteristics of SEGNI

• Camping: SEGNI camps are situated in the heart of the protected areas. During each program, camping with all necessary logistics will be organized at the selected campsite.

• Trekking: Interpretive hikes from the campsite into isolated areas of the park will be led by the SEGNI elders. The medicinal, spiritual and economical values of plants will also be explained.

• Tracking: Solitary time will be spent after the walks to encourage deeper reflection and individual connection with the natural environment. At the end of each day, participants will talk their mind, recall their perception and their learning and share with the other participants.

• Story telling: The African method of sharing knowledge through the age-old art of storytelling around the night fire will be practiced. Communication is always in the local language, with interpretation provided as needed. The stories, proverbs and games will be discussed for their moral and other values.

• Night watch: Each participant will have the responsibility of looking after the safety of his or her peers during an hour-long lone fire watch rotated throughout the night. This practice gives the opportunity for the participants to be aware of the night and sharpen their auditory senses.

Additional exercises including spending solitary time in the forest, listening to a tree, orientation skills, etc. are included to help the participants relate with the forest. The activities carried out helped participants: - to create emotional links with the forest and nature, develop their orientation skill, memory skill, understand forest/trees as living subjects, to recognize the beauty of forest from different directions, appreciate nature and the interactions of the community with in the forest, recognize that nature is the place when mind gets peace, and personal talents are triggered and broaden the vision and marvel at little “treasures”.

• Evaluation and entering into commitment: At the end of the process, participants will evaluate the program. The evaluation helps to improve the process and get clarity on some issue which may not have been understood during the process.

The participants will also enter into commitments. Most of the commitments circle around

- We will learn more from elders and share our experience to others
- We will plant seedlings of indigenous trees and rehabilitate degraded areas
- We will keep our school camps clean, build traditional hut in our school, collect cultural materials, medicinal plants, different seeds and crops and use them for learning about culture & biodiversity.
- We will celebrate cultural biodiversity day in our school.

2. Summary of activities done at the BMNP

• MELCA had the opportunity to carry out a cultural biodiversity celebration exhibition which is a follow up activity for SEGNI program in March 2006, together with Dinsho and Hora Soba Primary School.

• Orientation about the program and the criteria for selecting SEGNI participants was given to 9 schools located around the Bale Mountains National Park.

• Communications with government officials and different sectors related to the work of MELCA is strengthened through personal visits and other communication methods. A community management group, which comprises the community, the park, government and MELCA, was established.

• 11,205.75m2 plot of land was given from Dinsho Town Administration for establishment of nursery site and construction of MELCA's office. The allotted plot of land was fenced with barbed wire and a nursery site has been established and a total of 219,173 seedlings of Juniperus procera and Hagenia abyssinica were planted and about 85% are in good condition.

• After several meetings with the community of Hora Soba and Gayssay and local administration, an agreement has been reached with the communities to allocate land for soil and water conservation activities and for tree planting. They also set up a committee to work with us.

• To get an experience in nursery management, staff of MELCA and the local agricultural office went to Hitosa Nursery Site in Arsi Zone owned by our partner organization, Arsi-Bale Rural Development Project (ABRDP).

• MELCA also commissioned soil and water conservation senior expert and part-time nursery technician to give the direction for the nursery site management and for the implementation in general. A Project officer, Nursery site Forman and guard have also been recruited and the necessary nursery tools for the project have been purchased.

• At Hora Soba kebele and specifically at Orasha (Beraq) and Kelbo Tonsicho community more than 20,000 pits were prepared and 16,000 Juniperous procera and 4,000 Hagenia abyssinica seedlings were planted. 240 students of Aba Kera, Gayssay and Hore Soba schools and 350 local community members have participated in the tree planting operation. The area covered by tree seedlings is about 3.5 hectare. Out of this, the 65% of the land has been fenced by the

local community.

•MELCA is also working on soil and water conservation with the Hora Soba local communities'. 14 stone check dams were built along the gully with biophysical measures and 350 meter long cut-off drain and 10 Wooden check dams were also constructed in Orasha area. Different types of grasses-such as Vetiver, Bana, Green gold and Elephant grass was planted at the nursery site for climatic adoption trial.

• MELCA organized a two days Cultural Biodiversity Celebration and Mountain Nyala Day from December 23rd - 24th2006 at Bale zone Dinsho town, in partnership with Saint Louis Zoo, The Gaia Foundation, Frankfurt Zoological Society, Arsi Bale Rural Development Project (ABRDP) and the Bale Mountains National Park. The key participants were Seven Primary and Secondary schools from Menagesha Suba and Sebeta (Central Ethiopia) areas and nine schools from Dinsho (Around Bale Mountains National park HQ) areas.

Teachers, elders, youth groups, governmental officials and the local people around Dinsho town participated on the celebration. The total number of the participants of the celebration is estimated to be more than 2,500.

The students organized a Cultural Biodiversity exhibition which included collected plants and animals specimens, cultural dressings, local food items, collection of seeds, cultural artifacts, etc. Drama, poems on Mountain Nyala and traditional music were also presented to the audience.

In addition to this, the nursery site was visited by the participants of the celebration and a field visit for students and teachers of the Menagesha Bale to Senate Plateau was carried out.

3. The Overall Results of the program at the Bale Mountains National Park

3.1 Learning from elders:

• The students and youth groups, influenced by Western education, used to consider listening and talking to elders as backward. Because of this, they were neglecting the wisdom of elders. But, after they passed through the SEGNI program, they said that "what we thought was totally wrong and we observed that our elders have valuable knowledge which is as important as other forms of knowledge." They felt respect to their elders and committed themselves to learn from them when they return back to their school.

• As the participants said, they considered stories, riddles and sayings as fun only. But now, they recognized that how it is valuable and better way of transferring traditional ecological knowledge. From the stories told, they said "We saw that our elders have knowledge of ecology, psychology, astronomy, agriculture etc". Therefore, we believe that, traditional knowledge can contribute a lot for eradication of poverty and sustainable development.

3.2 Effect on the community:

• The community around the park is becoming interested in the program for they have observed that their children and youth groups are beginning to respect and listen to their elders.

3.3 Effect on teachers:

• The teachers were taught about the importance of plants and wildlife in the school. However, as it was not supported by practical way of learning and it was not as interactive as SEGNI program. As a result, they have recognized the value of traditional ecological knowledge for inter-generational transfer of knowledge from elders to the new generation.

• The teachers also realize that conserving the biodiversity (flora and fauna) and how much it is critical and related with the survival and the livelihood of human beings.

3.4 Inspiration out of interaction with forest & elders

• When the activities are being carried out in the forest, the participants are inspired to write poems and theatre concerning life, nature & culture and they presented on the campfire.

• Most of the participants before they passed through SEGNI process were afraid of darkness. However, after participants passed through the night vigil, they said that "Night has its own beauty and life. We heard different sound of wild animals that we did not hear during day time. The feeling of being oneself in darkness also forces oneself to look inside and confront one's principles and values". This is a beginning in critically looking at our life and identifying our internal strength.

• The participants said that, previously they considered their culture as primitive compared to the western ways of lifestyle. "But," they said; "we have known that our culture is rich enough in all aspects and we have to be proud of it and protect it."

• Though the participants were from around the park area, they never got the chance to visit and know about it before SEGNI program started to operate. They felt that they now "own" the park and promise to actively participate in conservation activities of the endangered mountain nyala and Ethiopian wolf.

3.5 Effect on decision makers:

The local decision makers after they participated in the SEGNI program showed positive support for the programme. They are providing supporting letters and relevant data quickly when they are requested. They are also encouraging schools to strengthen their activities to reach for the wider population. The creation of this good relationship also has created a good opportunity to organize cultural biodiversity celebrations at the school level and also to collate plants and animals specimens as well as in collection of some traditional goods, artifacts etc. which is very important for organizing cultural biodiversity celebration to reach a wider group of people.

3.6 Eco-advocates as agents for change:

The SEGNI participants are given a certificate and are called eco-advocates. The idea is for them to become change agents and change both their environment and their community towards responsible society. Students have started to be proud of their identity and they started to collect cultural materials and artifacts and put it in a room in their school. They also celebrate cultural biodiversity day.

The participants committed to improve their environment and society. They began to clean their school compound and give voluntary service to other initiatives in rehabilitating nature. In collaboration with the local community, students planted 20,000 indigenous tree seedlings around their school compound and community forest.

3.7 Empowering womens and girls:

Gender balance is one of the qualities of the program. MELCA insists that schools send equal number of women and men for SEGNI program. Emphasis is also given for the inclusion of women during training programs.

4. Production and distribution of information

MELCA had used some promotion materials to transmit some environmental and cultural messages:

4.1 Brochure

A brochure addressing the vision, mission, values, aim and objectives of MELCA,

SEGNI program, Mountain Nyala Day have been printed in three Languages; English, Amharic (Federal official language) and Oromiffa (Oromiya regional official language) and distributed on Cultural Biodiversity and Mountain Nyala Day for thousands of participants. In addition to the brochure, banners, T-shirts, bonnets (representing horn of mountain nyala) were also prepared and disseminated. The banners were posted around key areas Dinsho town.

4.2 Media briefings:

MELCA has given interviews on various topics to both electronic and print media in the year 2006.

- *Radio Interviews:* Interviews has been given on Traditional Ecological Knowledge and on the Merits and demerits of genetically modified organisms to the FM Radio run by Panos Programs.

- *Press coverage:* Interviews were given by MELCA Director on MELCA's work, value of Traditional Ecological Knowledge, etc. to the reporter Amharic Newspaper. The workshop that MELCA organized in South Region was also reported on the Regional media.

- *Celebration Media Coverage:* - The Cultural biodiversity and Mountain Nyala Day the whole activities were filmed and recorded by National Television and regional radio, and broadcasted for million audiences.

4.3 Supporting schools: MELCA has supported a total of Birr 11,430 for nine schools around the Northern part of Bale Mountain National Park and one Youth Nature Club. Out of this, because of their very good performance "Bale Beauty Youth Club" located in Goba town has got Birr 2,430. The club members after they passed through SEGNI programme, they contacted the Goba town administration and able to get around 5 hectare of land. The allotted plot of land will serve for nursery site establishment and for making small museum that serve for collection of plants and animals specimen, cultural goods, artifacts etc. By recognizing their need, MELCA has afforded Birr 2,430 for purchasing some nursery hand tools. The youth group activity is encouraging and they were active participants in the Cultural Biodiversity and Mountain Nyala Day celebrations. Likewise, for 9 schools that are found around Northern part of Bale Mountains National park, MELCA has provided a total of Birr 9,000 for purchasing of some nursery tools and to strengthen their participation on the Cultural Biodiversityand Mountain Nyala Day.

5. Monitoring and Evaluation

At the end of each SEGNI programme, there is an evaluation session. Each of the participants is involved in evaluating the performance of the programme. Next to this, each of the participants will promise to perform something for the conservation of the ecosystem and their culture. The MELCA staff members main duty is to follow up whether they have performed what they promised or not. In addition to this, on six months basis, the Monitoring and Evaluation Committee that is drawn from governmental offices including MELCA project office and Bale Mountains National Park, will conduct the monitoring and evaluation activities. If there is any problem, based on their findings and recommendations, MELCA office will take some corrective measures. Until now, we have not met with any critical problems.

IUCN Red List 2007

The following reassessments have been made for the 2007 Red List, due to be launched officially in September 2007 (www.iucnredlist.org). This marks the first stage in a reassessment of all antelope species in time for the 2008 Red List. Many thanks to all those who participated in drafting, commenting on or evaluating assessments.

David Mallon, ASG Co-Chair

2007 Red List Reassessments

		2007 assessment	Previous assessment	
Tragelaphus buxtoni	Mountain Nyala	EN C1	EN A1a, C1	1996
Beatragus hunteri	Hirola	CR A2acd	CR A1a	1996
Ammodorcas clarkei	Dibatag	VU A2cd	VU C1	1996
Gazella cuvieri	Cuvier's Gazelle	EN C2a(i)	EN	1996
Gazella dorcas	Dorcas Gazelle	VU A2cd	VU A1a	2000
Gazella leptoceros	Slender-horned gazelle	EN C2a(i)	EN C1+2a	1996
Gazella soemmerringii	Soemmerring's Gazelle	VU A2cd+C1	VU C1	1996
Gazella spekei	Speke's Gazelle	ENA2cd	VU C1	1996
Procapra picticaudata	Tibetan Gazelle	NT	LC	2003
Dorcatragus megalotis	Beira	VU C1	VU C1	1996
Madoqua saltiana	Salt's Dikdik	LC	LR/lc	1996
Cephalophus spadix	Abbot's Duiker	EN C2a(i)	VU C1	1996

Regional Rundown

North East Africa

Occurrence of antelopes in Southern Sudan's Boma National Park

Report from Jens-Ove Heckel

On request of the Northeast African Subgroup of the Antelope Specialist Group, information regarding the occurrence of antelopes in Southern Sudan was recently made available through the NGO "Tierärzte ohne Grenzen e.V./Vétérinaires sans frontières Germany" (VSF-G). VSF-G carried out a two-weeks survey, in cooperation with VSF-Belgium and the PACE cattle pest project, and blood-sampled wild ruminants in Boma National Park for cattle pest serology in February/March 2004.

Members of the VSF-G team reported (past on by Klaus Lorenz, VSF-G) that White-eared kob *(Kobus kob leucotis)* were spotted frequently and in large herds. "About thousand" of these animals could be observed in Pantiu/Okade, whereas even "thousands" where reported in Abobo. Further the fact needs to be considered that from January till May the kobs obviously mainly occur on the Ethiopian side of the border, whereas from May till December they favour areas on the Sudanese side. Further observations included a herd of African buffaloes *(Syncerus caffer)* of 15-20 animals, two herds of Common Eland *(Tragelaphus oryx*) of about 15 individuals each, as well as a herd of Roan antelopes *(Hippotragus equines)*. Reedbuck *(Redunca redunca)* and Tiang *(Damaliscus lunatus tiang)* were frequent, whereas Tiang mainly occurred together with White-eared kob. Dikdiks were "all over the place", most likely being Guenther's Dikdik *(Madoqua guentheri)*. Defassa waterbuck *(Kobus ellipsiprymnus defassa)*, other gazelles or giraffes weren't seen at all.

Poaching is still occurring on a large scale and is therefore the main problem for the park. Especially buffaloes were almost exterminated because of intensive hunting by the local Murle tribe. Several times, the survey team encountered (accompanied by park wardens) groups of hunters with freshly bagged buffalo meat and one killed Eland antelope. Obviously, the only rudimentary governmental structures in Southern Sudan aren't able to keep the situation under control.

VSF-G team members were not able to give any other reliable information about the occurrence of antelopes and other wild ruminants from other regions of Sudan.

In general, the security situation in Southern Sudan is still critical. Even in times of relative peace there have often been break outs of violence. In the first half of the year there were security problems and fightings in the Boma region as well as in Gogrial East (Bahr al Ghazal).

The members of VSF-G mainly move between the separate project regions by planes. Juba, the capital of Southern Sudan is now extended into an administration center and soon, there will be a scheduled flight from Nairobi to Juba. Up to now you can only get to Southern Sudan via UNO-flights from Northern Kenya.

Further information on the Northeast African Subgroup of the Antelope Specialist Group is available through the regional coordinator Jens-Ove Heckel jens-ove.heckel@landau.de, or www.iucn.org/themes/ssc/sgs/neaasg/layout/1024.htm

Herds Rediscovered in Southern Sudan

June 12, 2007—A herd of white-eared kob antelope run along the Kangen River in Southern Sudan's Boma National Park.

The photograph was taken as part of the first aerial surveys of the newly autonomous region in 25 years.

The 58,000-square-mile (150,000-square-kilometer) series of surveys reveals that wildlife, including at least 800,000 kob, have endured despite a ruinous civil war.

"Seeing thousands upon thousands upon thousands of white-eared kob streaming under the aircraft, day after day, was like I had died and was having the most unbelievable dream you could ever have," said J. Michael Fay, a Wildlife Conservation Society biologist and National Geographic explorer-in-residence who helped lead the survey.

The survey team also found beisa oryxes, which some Sudanese officials said were extinct in the area, and 4,000 Nile lechwe, a type of antelope thought to have been nearly wiped out. The survey also reported 250,000 Mongalla gazelles, 160,000 tiang, 13,000 reedbuck, and 2,800 ostriches.

The kob migration in southern Sudan is believed to be one of the largest on the planet, rivaling those of the wildebeest in the Serengeti and the Mongolian gazelle in China.

Reprinted from National Geographic News which is part of the National Geographic Society.

Editor's note: ***GNUSLETTER*** *has been in contact with Paul Elkan, ASG member, who will provide a report on the Boma N.P. survey in a future* ***GNUSLETTER***..

Central and West Africa

St. Louis: 20 Dorcas gazelles from Spain offered to Senegal - Le Soleil

As part of the implementation of its policy to restore Sahelo-Saharan wildlife to the wildlife preserves of Gueumbeul and Ferlo North, the Experimental Center for Arid Zones of Almeria in Spain has offered to the Senegalese department of national parks a group of twenty Dorcas gazelles composed of fourteen females and six males. The gazelles offered to Senegal by Spain landed at Bango International airport in the presence of the Minister of the Environment and Protection of Nature Thierno Lô, Governor Mouhamadou Moustapha Ndao, the National Parks Manager, Colonel Mame Balla Gueye, several other administrative authorities and high-level managers from water resources and forestry services.

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After disembarking from the Royal Spanish Army Transall aircraft at 2:45 PM, the animals were transported to the special wildlife reserve at Gueumbeul located in the Gandiolais, about 20 kilometers from the northern capital. A large delegation of forty people, of which a dozen were journalists, made the trip from Spain to help with the transfer.

The gazelles were placed in this reserve, in suitable surroundings which will permit them to acclimate and reproduce before being relocated to another Senegalese environment. They come to be added to the animal populations of this reserve which is the first breeding center for wildlife in our country. Covering an area of 720 hectares, it provides shelter for Mhorr gazelles, the largest and most beautiful of the Sahelo-Saharan gazelles which one can observe in complete freedom in the wild, as well as the Scimitar-horned Oryx, another variety of antelope.

Also found in this reserve is the Sulcata tortoise which is the largest of the African tortoise, as well as the Patas monkey.

Proximity to the Gueumbeul basin provides spectacular scenery. This reserve accommodates almost a hundred species of birds and is noted for its large concentrations of flamingos and avocets.

In the name of President Abdoulaye Wade and Prime Minister Macky Sall, Minister Thierno Lô delivered a glowing homage to the Kingdom of Spain which offered these twenty gazelles to our country.

According to Minister Thierno Lô, this gracious and environmentally important gesture by our Spanish partners permits the Kingdom of Spain to contribute effectively to the implementation of our preservation policy and to the conservation of our wildlife and natural resources. We are also delighted at the training from which our eco-guards have benefited in Spain for the monitoring of these nimble and fragile gazelles.

Lastly, Minister Thierno Lô gave recognition to the purpose of this reserve which plays a predominant role in the improvement of the living environment of the neighboring populations which get the most benefit from it.

- Mbagnick Kharachi Diagne

Reprinted from Le Soleil article

Southern Africa

Giant Sable Report

Gerhard Damm interviews Pedro vaz Pinto about the Palanca Negra

Introductory Note: In May 2005 (Volume 3, # 3) **African Indaba** brought an article by Brendan O'Keeffe about the history of the search for the once thought extinct Giant or Royal Sable *(Hippotragus niger variani)*. In Angola this magnificent species is called Palanca Negra. At that time, I informed the readers that Professor Christian Pitra had already established conclusive DNA sequences from dung samples and that a group of Giant Sable had been photographed by infrared triggered still cameras, installed and monitored by Pedro Vaz Pinto. In our section "News from Africa" we sporadically bring further bits and pieces of encouraging news about the precarious existence of this remnant population of the Angolan flagship species. In the recent months, Pedro vaz Pinto's untiring activities produced more results and finally led to a Giant Sable Symposium in Malanje/Angola in mid September.

Gerhard Damm: Pedro, can you give the readers of African Indaba some first hand information of what happened during the past half year in Luanda and Cangandala?

Pedro vaz Pinto: In May 2006 I visited Cangandala National Park together with Luis Veríssimo. Luis is preparing the GIS cartography and mapping for the giant sable region, including Cangandala NP and Luando Reserve. The "Pastores da Palancas" (Sable shepherds), a small dedicated group of men from a local Songo village, who consider the Giant Sable their totem animal, had watched over them for generations, and we had revived that custom during the 2002 expedition. This proved to be very beneficial, because with renewed pride and dedication, these men are very active in anti-poaching. Visible proof was an AK47, recently confiscated from a poacher, which they proudly showed us.

The park was quite dry and river-crossing not too difficult, and we made camp next to the Cazela. On the second day we walked to the salt licks, where the three cameras had been placed. They were in good working order and two had registered five respectively 10 events. We installed a multi-trigger device which links six cameras. We also installed a video camera, operated by a movement/heat detector, which is triggered also by an infrared system.

In July the expedition to Luando Reserve with three 4x4s took us two full days of driving to reach the Kwanza River at Dando, at the southwest of the reserve, only to find the ferry to be broken. There seems to be a problem with illegal diamond mining in the area and little law and order.

We decided to head north to explore the left bank areas of the Kwanza, with more affinities with some of the northern Miombo woodlands of the reserve, and where alleged records of

giant sable appear from time to time but were never proven. Luis Veríssimo had already identified this region as being potentially the most interesting from satellite imagery interpretation, considering the relatively lack of human presence and the excellent state of the woodlands. Unfortunately our visit coincided with the first fires, so half of the area was unburnt and with very tall grass, and the remaining area was either burning or very recently burnt. We did a few walking incursions into the magnificent woodlands and we could confirm the presence of game, based on prints, dung and lots of trails. These woodlands seem to be richer in wildlife than the woodlands in the giant sable reserves. Most of the tracks found belonged to *Hippotraginae*, assumed by us to be of roan. Every one we interviewed agreed that roan was pretty common but they all denied that there were sables this side of the Kwanza. We even found a couple of ex Unita soldiers, who shamelessly admitted having killed quite a few giant sables (only time they saw them) when they were based in the Luando Reserve near Quimbango – they were just meat they said smiling… it was the first time I found someone willing to admit what we already knew…

Apart from the almost continuous pristine Miombo, a very striking feature of this region is the total absence of "anharas" (open areas). The presence/absence of anharas may be a relevant factor influencing the sable distribution in the region. We are now inclined to consider the possible existence of giant sable left of the Kwanza River as mistaken or historically accidental. The main problem right now is that the Luanda Strict Reserve is the core area for the giant sable distribution, and the whole reserve seems to be simply out of reach by land at this stage!

In August I returned to Cangandala with a small party including South African ornithologist Michael Mills. Once in the park, we were informed of a huge bush fire that had erupted a couple of days back with the area of the salt lick right in the eye of the fire storm. The shepherds had chased away two poachers and an AK47 with ammunition, two bicycles, backpacks and one spotlight were confiscated for use by the shepherds.

The next day we walked to the salt lick, and saw that the simple fire breaks we had made in June proved fairly efficient and even if a couple of camera units showed some very slight damage they were all working. We discovered sable spoor in the hard soil. I spent a couple of hours resetting all the units saving the video camera for last…and immediately we could see that we had 1h04m of footage. I found a comfortable place to sit next to a tree, and started playing back the film. The first minute of footage showed the test, the following minute a couple of bush duikers. The date marked July 23 17h35m, which meant that the camera had been there for 29 days until registered the first event! Then a couple of warthogs getting close for a few seconds before running away for some unknown reason and the date read July 29th 14h23m.

And then we hit the jackpot! On August 3rd the sable herd came to the salt lick and was filmed! Just 48 hours before the big fire and 3 days before we left Luanda! We got about one full hour of footage showing the sable herd, the same herd we now begin to know so well, moving around the site. We can see mostly females, juveniles, young and old ones, including some we knew from previous encounters like the alpha female - a strikingly beautiful old female very well proportioned and with perfectly symmetrical horns, the one with a shorter right horn, and the one with the white stripe. I'm still in the process of analysing in very detail the whole footage but it seems to be about 3 to 4 juveniles, of which at least one is male, 1 to 3 young females and 3 to 4 mature/old females. There were no very young calves, possibly because they were left behind before the herd would approach the salt lick… and there was just one sub-adult male, not yet black, but already dark brown and showing curving horns.

The behaviour seems to be very interesting with the females acting quite aggressively towards each other, probably a sign of the rutting season approaching. The first female arrived at the site at 09h35 but she was very suspicious at first and only about 20 minutes later they made the final approach. They stood there until 10h09. The film should be of excellent quality and is certainly more than enough for our present needs, but I am not entirely happy with the sharpness,

GRD: Did you ever come across a mature adult bull?

PvP: Obtaining the sable film in August was a very happy moment, In the footage, I was able to identify, amongst others, seven beautiful old giant sable females, one three year old female and one 2005 male calf. I still believe that there is a master bull somewhere, just waiting for us! I have now instructed the shepherds to spend more time searching some particular areas where we believe he might be, and to see if we can find alternative salt licks. As the DNA results so far haven't proved to be entirely convincing, we need to get other ways to be sure, if we have a second herd in Cangandala or if we are down to just this one. And in the process, getting the bull would be more than a bonus! Even if we assume that territorial bulls may be more vulnerable to poaching, we still should have a couple of breeding bulls left.
In the meantime, I expect to have the herd at the original observation point very well monitored, and all the individuals identified. We will use only remote operated video and still cameras to leave this herd as undisturbed as possible. I must also invest time exploring more areas.

GRD: You told me that you went back to Cangandala in September. Any news from this last expedition?

PvP: I had asked the shepherds to find a new salt lick in order to get be able to observe other sable groups. If the shepherds couldn't find one, I planned to put some cameras on a promising salt lick site I had found last year 10km further south. When I arrived at Cangandala no new poaching incidents were reported for the past weeks, and the shepherds had indeed found a new salt lick which apparently was being heavily used by sable!
I started by going to our old salt lick This time the video system had recorded 14 minutes of footage, of which about half resulted of two independent events which were recorded early in the morning, between 6h30 and 9h30. But no sable though. Later that evening I used my laptop to show the August sable movie and some slides to a very interested audience.

Early next morning we drove through woodland towards the new salt lick. We stopped the car less than 300 meters from the site and walked for 100 meters. Suddenly the shepherds

ducked to the ground and started pointing excitedly to the lick: The sable herd was right there! I eventually crawled to within 60 meters from them! The bush is so dense that I never got a clear view although I observed them for at least half an hour. I didn't want to risk frightening the animals trying to get a good picture when they were taking in salt. It was a group of six animals with a dominant female leading the party; four young animals – three males and one female – and a calf around four months old whose little horns were just beginning to show. Finding five young animals here may help explaining why there were so few young in the other salt lick.

The salt lick area was covered with sable spoor, suggesting that they use this place a lot. Moreover there was a second salt lick 100 meters away showing similar signs of constant use. This area, densely covered with bush, seems to be favored by the sables. I placed our second video camera almost on top of the salt lick, and hope for some excellent close-up footage soon! We also placed a stills camera at the site. I also admit to speculating that this site must be in the core area of the sable herd, and then also likely right inside the bull territory! So, I really feel we're getting closer!

GRD: Did the Malanje Conference further the Giant Sable Project?

PvP: The September Conference with an ambitious program and over 200 participants, including ministers and senior government, officials in Malanje was a huge success for the Giant Sable Project. The Governor of Malanje, Cristóvão da Cunha welcomed the participants and Minister of Environment Sita José followed with the opening speech. Bill Cummings, public affairs manager for ESSO Angola presented a check for US$111,000 for the rehabilitation of the park infrastructures in Cangandala to the secretary-general of the Catholic University, Father Imbamba. Professor Brian Huntley from South Africa presented a broad overview of Angolan biodiversity with a series of slides of Angolan wildlife, and a special focus on the giant sable. Vladimir Russo, of the Angolan National Biodiversity Strategy and Action Plan and advisor to the Minister of Environment presented the Government's strategy for the conservation of Angolan biodiversity and explained why the giant sable is a national prority.

In a final ceremony the Memorandum of Understanding between the Catholic University, the Ministry of Environment and the Provincial Government of Malanje was officially signed. The Minister also announced the appointment of Cardoso Bebeca as Park Administrator for Cangandala.

The project is now stronger than ever before; with the Government's participation and the institutional framework in

place we have reason to be optimistic. In the next few months we need to define very urgently our course of action, and it is becoming very clear that in 2007, drastic measures will have to be taken in order to save the sable population in Cangandala.

GRD: We heard from Dr. Jeremy Anderson that he missed seeing Giant Sable by mere minutes in Cangandala?

PvP: Nine of the conference participants and I went to the park for some field work. During the night and early morning we had the first rain of the season. After breakfast we headed towards salt lick nº2 to check the video camera. The film showed that two giant sable cows had been in the salt lick just a couple of hours earlier! We then drove through the woodland towards salt lick nº3, but the cameras there showed no activity! A couple of hundred meters away is another salt lick that last month had been less utilized, but this time it was a different story! There was very fresh spoor all over this site, and the sables must have been there while our cars approached.

Reprinted from Africa Indaba, Nov. 2007

North Africa, Asia, Middle East

Idmi gazelle release, Thummah, Saudi Arabia

Seventeen mountain gazelle have been released into the wild

Captive-bred mountain gazelles have been successfully released into the wild for the first time in 10 years.

Conservationists released 17 of the creatures into the Ibex reserve in Saudi Arabia.

The mountain gazelle *(Gazella gazella)* is at a high risk of extinction because of factors such as habitat loss and hunting.

Some of the gazelles have now been radio-tagged so scientists can track them as they explore their new home.

The radio collars will provide information about the dispersal and establishment of the animals on the reserve, as well as their survival.

"After many years of dedicated work to identify and conserve different species of gazelles in Saudi Arabia, it is fantastic to see a successful release of these elegant creatures," said Dr Richard Kock, head of the Deserts and Rangelands Conservation Programme at the Zoological Society of London (ZSL).

The gazelles were bred and raised at the King Khalid Wildlife Research Centre, in Thumamah, Saudi Arabia.

Reprint based on Zoological Society of London press release to the BBC.

Translocation of addax and oryx: a big step towards the restoration of Saharan wildlife in Tunisia.

As part of the CMS[1] /FFEM[2] "Sahelo-Saharan Antelopes" project, the Tunisian Direction Générale des Forêts, in collaboration with several international institutions, has reintroduced two groups of addax and one group of scimitar-horned oryx, wild desert ungulates, into the Tunisian national parks of Djebil, Senghar and Dghoumes. These translocations represent a major advance towards the restoration of Tunisia's natural heritage.

As part of the CMS/FFEM "Sahelo-Saharan Antelopes" project* for the conservation of biodiversity, a major translocation operation of addax *(Addax nasomaculatus)* and scimitar-horned oryx *(Oryx dammah)* was organized in Tunisia from 20-26 February, 2007. The operation consisted of capturing 20 addax and 10 oryx from Bou Hedma National Park (governorate of Sidi Bouzid) and transporting them to 3 national parks, Djebil near Douz, Senghar near Tataouine (Saharan parks for the addax), and Dghoumes (governorate of Tozeur) for the oryx.

The goal of these translocations is to create several semi-captive populations or oryx and addax in different national parks, to better manage genetic diversity of these populations and to limit the risk of massive die-off from potential epidemics, and above all to prepare for the reintroduction of addax to the wild in the Great Oriental Erg, a vast Saharan area of dunes at the frontier between Tunisia and Algeria.

The operation took place without incident. Twenty addax were captured using anesthesia rifles, transported in crates by truck overnight, and released in the morning in Djebil and Senghar NPs. Using the same technique, 8 oryx took the road to Dghoumes NP. Numerous samples and scientific data were taken (health, genetic and biometric monitoring of the animals, etc.). The captures were accompanied by field studies by Algerian, Moroccan, Senegalese and Tunisian professionals, who participated actively in all phases of the translocations and were able to exchange strategies for conservation in the various neighboring countries.

The operations were placed under the authority of the Direction Générale des Forêts (Ministry of Agriculture, Tunisia) and organized by the CMS. The Fonds Français pour l'Environnement Mondial (FFEM) is the principal financial backer of the project. Numerous scientific institutions were associated with this operation, of which the IRSNB (Institut Royal des Sciences Naturelles de Belgique), the IGF (International Foundation for the Conservation of Wildlife), ZSL (Zoological Society of London), the French National Natural History Museum, and La Palmyre Zoo.

Following this, and under the supervision of the international community of zoological parks, a group of addax and oryx should arrive in the autumn of 2007 (Djebil and Senghar NPs for the addax, Dghoumes NP for the oryx) from European and North American zoos in order to increase the genetic diversity of these populations.

The translocations hold a symbolic attribute essential to Tunisia and for the international nature conservation community, and are part of a long-term programme for restoration of Tunisia's natural heritage and in particular for the reintroduction of addax in nature.

[1]CMS = Convention on Migratory Species (CMS/UNEP)
[2]FFEM = Fonds Français pour l'Environnement Mondial (French Global Environment Fund)

Press release of the Sahelo-Saharan Antelopes translocation operation in Tunisia, February 2007. More information on the operation in a forthcoming Gnusletter will be provided by ASG Co-Chair Philippe Chardonnet who was coordinating the technical and veterinary aspects of the translocation.

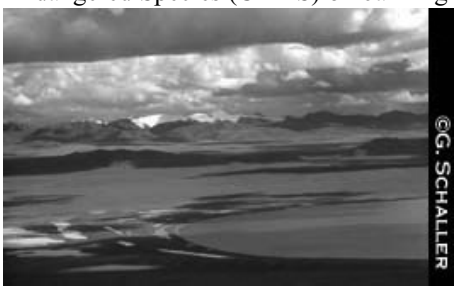
Tibetan Antelope are recovering

Findings from a 1,000-mile expedition

February 1, 2007 -Once threatened by rampant poaching, the Tibetan antelope or chiru may be recovering according to legendary conservation biologist George Schaller, who just completed a 1,000-mile expedition across Tibet's remote Chang Tang region. Schaller, a biologist with the Bronx-zoo based Wildlife Conservation Society (WCS), says better law enforcement and growing conservation ethic in local communities may be the reason for the resurgence.

"China has made a major effort to control poaching," said Schaller. "The large poaching gangs of the 1990s, which were at times arrested with 600 or more chiru hides, largely ceased to exist... These wholly local Tibetan initiatives are the best means of establishing long-lasting conservation efforts, and they should be encouraged in every possible way."

Tibetan antelope were widely poached for their wool, known as shahtoosh. Fed by the shahtoosh fashion craze of the late 1980s in Europe and the U.S., wild chiru populations plummeted to around 75,000, according to Schaller, with an annual harvest rate of 20,000. Protection efforts from the Chinese government, local conservation interest by the nomadic communities living in the Chang Tang region, and a dip in shahtoosh demand partly due to awareness campaigns by conservation groups may have saved the species. In March 2006 the U.S. Fish and Wildlife Service listed the chiru as an endangered species, joining the Convention on International Trade in Endangered Species (CITES) on banning



trade of products made from the species.

The expedition, which included Schaller, WCS staff member Aili Kang and a team of Tibetan and Han-Chinese biologists and field assistants, found some 9,000 Tibetan antelope. They also counted more than 1,000 wild yak, a species even more endangered than the chiru due to hunting and hybridization with domestic yak.

Schaller's expedition, co-funded by WCS and National Geographic, traversed the entire northern Chang Tang region, an uninhabited region that often ranged between 16,000-17,000 feet. Schaller says the journey hadn't been completed in over a century, when in 1896 two British army officers made the journey

on horseback. Schaller used two Land Cruisers and two trucks – one of which was lost in a frozen lake.

WCS says that much of the journey took place across Chang Tang Reserve, a Colorado-sized park established by the Chinese government in 1993.

Reprinted from National Geographic News

Interest Groups

Brief Overview of the International Giraffe Working Group (IGWG) Activities

David Brown & Julian Fennessy

• The International Giraffe Working Group will soon be releasing the second edition of its newsletter, Giraffa. Giraffa is an electronic publication and is available freely to all those who subscribe. If you would like to receive a copy of the new edition or a copy of our first edition please contact David Brown at: giraffes@ucla.edu

• We are launching an effort to census and assess the conservation status of giraffe populations across Africa. This initiative is being developed under the auspicious name of: the 'Giraffe Database (GiD)'. Details on our plans are discussed in the accompanying article. Furthermore, project and details of how individuals/organizations/ institutions can participate are discussed at length in the new edition of Giraffa.

• The giraffe population in the Niamey region of Niger is among Africa's most endangered large mammal populations. This population is the last known giraffe population in all of Africa west of Cameroon and numbers approximately 160 individuals. The population seems to be increasingly and is the subject of much conservation interest. A conservation workshop held by the Government of Niger and ECOPAS, funded by the EU, was held in late 2006 to assess the conservation status of this giraffe population and develop an action plan. Unfortunately, although enthusiasm prevailed, little action has followed on the ground. However, very recent news indicates that a collaborative conservation effort is set to begin which should provide the first stage of the action plans implementation. Keep an eye out for forthcoming news.

Recent Publications

Remnants of ancient genetic diversity preserved within captive groups of scimitar-horned oryx *(Oryx dammah)*

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Keywords: antelope, captive breeding, conservation genetics, Hippotragini, North Africa, oryx

Scimitar-horned oryx, now considered extinct in the wild, persists in large numbers in captivity. In this first molecular genetic study on this species, we explore the patterns of genetic diversity across European, North American, and a few other captive groups using microsatellite markers and mitochondrial control region sequencing. Strong population structure was not evident from microsatellite data but we discovered deep divergence within the mitochondrial DNA haplotypes from a network analysis where three disconnected networks were obtained, with estimated divergence times of c. 2.1–2.7 million years. Mismatch distribution analyses suggest population expansions c. 1.2 and 0.5 million years ago. We discuss our findings in the context of historical climatic changes in North Africa and use information obtained on current patterns of genetic diversity within captive groups to make recommendations for future captive management and reintroduction strategies.

Introduction

Captive breeding is seen to play an increasingly important role in the conservation of threatened species. Several species such as the scimitar-horned oryx *(Oryx dammah)*, the Przewalski's horse *(Equus ferus przewalskii)*, and the black-footed ferret *(Mustela nigripes)* have been successfully retained in captivity after extinction in the wild. This trend is likely to continue in the future since thousands of threatened species are thought to require captive breeding over the next few hundred years in order to prevent them from going extinct (Tudge 1995). Regional and international programs now exist for many endangered species in captivity where coordinated breeding and management is practised. Efforts are made to preserve the genetic variation of the wild population from which founders were drawn, to minimize loss of this initial diversity as a consequence of inbreeding, and to produce appropriate animals for reintroduction to the species' former range (Russello & Amato 2004).

The scimitar-horned oryx (SHO) belongs to the Hippotragini tribe within the Antilopinae subfamily of Bovidae, along with addax *(Addax nasomaculatus)*, roan *(Hippotragus equinus)*, sable *(Hippotragus niger)*, and two other oryx species, the Arabian oryx *(Oryx leucoryx)* and the Plains oryx or Gemsbok *(Oryx gazella)*. During the middle ages, SHO is known to have spanned right

across North Africa, from Mauritania on the Atlantic coast to Sudan on the Red Sea, along the interface between true desert and the less arid 'North Saharan/Mediterranean' habitat and the 'Sahelian' habitat (region bordering the Sahara to the south and varying in width from several hundred kilometres to over 1000 km) (Newby 1978, 1980). Populations on the northern fringe of the Sahara are thought to have disappeared by the beginning of the 20th century, with the southern Sahelian range remaining almost continuous until the 1960s (Fig. 1). Continued fragmentation eventually led to the extermination of the species from across this

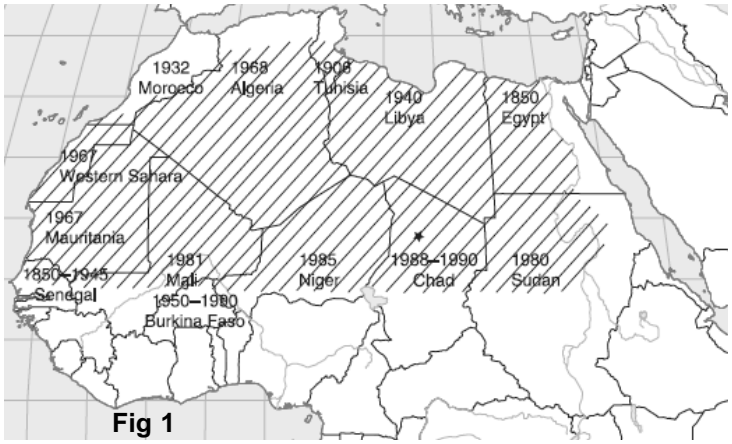

Fig 1

region, with the last confirmed sightings made in Chad in the mid-1980s (Newby 1988). Reasons for the decline include drought, loss of habitat, over-hunting, and competition with domestic livestock (Jackson 1978; Newby 1988; Dixon et al. 1991). SHO is now officially classified as extinct in the wild (IUCN 2006) but exists in large numbers in captivity, and there may be as many as 6000 animals held in zoos, private collections, and ranches worldwide (Gilbert 2005). Although there are records from the 1930s of a small number of individuals that may have contributed to the modern captive groups, the vast majority of founders were captured in Chad in the 1960s (Wakefield et al. 2004). This consisted of three animals caught in 1963 and taken to the USA, and a greater number (c. 44) captured in 1967 (Fig. 1), of which c. 26 were taken to USA, c. 18 were brought to Europe, and a handful of individuals were sent to zoos in South Africa and Japan (A. Rost, personal communication). Descendants of the North American and European animals are now managed within the Species Survival Plan (SSP) of the American Association of Zoos & Aquaria (AZA), and the European Endangered Species Programme (EEP) of the European Association of Zoos & Aquaria (EAZA), respectively. Other coordinated captive breeding programmes exist in Australasia and Japan, and there are also SHO in parts of the world that are not covered by any such programme.

There is considerable interest in the re-introduction of SHO to parts of its former range and as many as 13 North African countries have become signatories to the 'Action plan for the conservation and restoration of Sahelo-Saharan antelope and gazelle' (Beudels-Jamar et al. 1998). Captive-bred SHO have already been successfully released into protected areas in Tunisia, Morocco and Senegal (Gordon & Gill 1993; Wakefield et al. 2004). In this first genetic study on the SHO, we explored the extent and patterns of genetic variation within the EEP and SSP groups which represent the most significant captive management programmes in terms of size (c. 460 and 230 individuals, respectively) and numbers of founders (Gilbert 2005). Small numbers of additional samples from other captive groups and from museums were also used for comparison. We report on the current mitochondrial and microsatellite diversity in these captive groups, and based on our findings, make inferences on historical patterns of demography and suggest future management strategies for this species.

Materials and methods

Samples

We obtained faecal, blood, and ear/muscle biopsy samples. Three to six fresh faecal pellets were placed in 50 mL tubes containing c. 30 g silica gel (Type III indicating, Sigma) with a small piece of filter paper separating the faecal material from the silica gel (Wasser et al. 1997). The tubes were held at ambient temperature for several weeks prior to being stored long term at 4 °C. Blood was collected by zoo veterinarians and shipped within 24 h for processing, or held at ?20 °C and shipped frozen. All tissue samples were placed in 100% alcohol and shipped at ambient temperature. A total of 122 faecal and 35 blood/skin samples were obtained from EEP participating zoos (UK, Spain, France, Greece, Holland, Germany, Portugal, Denmark, Poland, Croatia, Czech Republic, and Israel). Sixty-nine faecal samples could be allocated to specific individuals but the remaining 53 were unidentifiable. An additional 6 and 19 faecal samples were also obtained from Pretoria zoo, South Africa, and Dubai Desert Conservation Reserve (DDCR), United Arab Emirates, respectively (total faecal sample n = 147). The 35 blood/skin samples included two samples from Marwell zoo, which were from animals that were translocated to Australia in 1987. Forty-eight tissue samples were obtained from various zoos/ranches within the USA, which consisted largely of muscle biopsies taken using remote injection darts by trained professionals, and a smaller number of blood/necropsy samples taken during veterinary procedures/autopsies. A small number of museum samples were also obtained, which consisted of pieces of pelt from animals collected in Sudan (1824, n = 1, 1911, n = 3) and Chad (1925, n = 1), and a tooth from an animal collected in Chad (1960s).

DNA extraction

DNA was extracted from faecal samples in a dedicated area using the QIAamp DNA stool mini kit (QIAGEN) according to manufacturer's instructions but with the following modifications: c. 100 mg dried faecal material was placed in an Eppendorf tube with 1.8 mL ASL buffer, mixed thoroughly, and allowed to incubate at 37 °C for 12–24 h, and the final postextraction elution step was carried out for 30 min. A maximum of 15 samples were processed at one time with 1–2 negative controls. DNA was extracted from blood using the protocol described in Bruford et al. (1998), and from skin biopsies using a standard phenol–chloroform protocol (Milligan 1998). In the case of museum samples, pieces of pelt were cryopulversied in liquid nitrogen using an MM300 mixer mill (Retsch) and c. 200 mg of powder placed in 5 mL of extraction buffer (0.45 m EDTA pH 8, 1% sarcosyl, 0.4 mg/mL proteinase K), followed by the procedure described in Vigilant et al. (2001). For DNA extraction from teeth, a hand-held drill was used to make a hole in the root and a small amount of material collected and used as described above. All these procedures were carried out in contamination-free areas with appropriate negative controls.

Microsatellite analyses

A set of six microsatellite loci previously described in sheep (MAF46, MAF50, OarFCB304, OarAE119, OarCP26) or cattle (RBP3) and found to amplify polymorphic alleles in Arabian oryx (Marshall et al. 1999) was used. Polymerase chain reactions (PCR) were carried out in a 15-µL volume containing 2 µL template, 1× PCR buffer (ABgene, 75 mm Tris-HCl, pH 8.8, 20 mm (NH4)2SO4, 0.01% (v/v) Tween 20), 1.0–3.0 mm MgCl2, 12 µg BSA (Roche), 200 µm each dNTP, 200 nm each primer and 0.4 U DNA polymerase (ABgene). Amplification conditions consisted of initial denaturation for 4 min, followed by 30–45 cycles (blood and faecal DNA, respectively) at 94 °C for 30 s, 54–62 °C annealing temperature for 30 s, and 72 °C for 30 s, followed by a final extension at 72 °C for 10 min. The 5' end of the forward primer was fluorescently labelled and the products were separated using gel electrophoresis on an ABI PRISM 377. Alleles were sized relative to an internal standard (HD400 with ROX label) and scored using genescan 3.0 and genotyper software (Applied Biosystems). In the case of faecal samples, heterozygous genotypes were accepted once confirmed in two separate amplifications, but homozygous genotypes were repeated 4–6 times to ensure high levels of accuracy.

Mitochondrial DNA sequencing

PCR amplification of either the complete control region (1.24 kb) (primers SHODLOOPFOR 5'-TCAAGGAAGAAGCTATAGCC and SHODLOOPREV 5'-CATCTAGGCATTTTCAGTGA described in Iyengar et al. 2006) or a shorter 353-bp product (primer SHODLOOPFOR and primer SHODLOOP350REV 5'-TGTGGTACGTCGGTTTGC) was carried out in a 30-µL volume containing 2 µL template, 1× PCR buffer (ABgene), 2.5 mm MgCl2, 24 µg BSA, 200 µm each dNTP, 200 nm each primer and 0.5 U Taq DNA polymerase (ABgene). The large product was amplified from all tissue samples but with faecal samples, upon failure to amplify the large product, attempts were made to amplify the smaller 353-bp product. Amplification conditions were as follows: initial denaturation for 4 min, followed by 30–40 cycles (blood and faecal DNA, respectively) of 94 °C for 30 s, 55 °C for 30–60 s (0.35-kb and 1.2-kb products, respectively) and 72 °C for 30–60 s (0.35- and 1.2-kb products, respectively), followed by a final extension at 72 °C for 10 min. In a few cases (n = 4), amplification of the larger product was carried out using both blood and faecal DNA in order to confirm identical sequences from both sources. In the case of museum samples, two separate PCRs were carried out for each sample amplifying overlapping products of 129 bp and 125 bp using primers SHOMUSFOR1 (5'-GAAGCACTATCAATATATCCC) and SHOMUSREV1 (5'-GTTATGAAATTTCCGCGTGC); and SHOMUSFOR2 (5'-TCAACACAAACTTTCCACCC) and SHOMUSREV2 (5'-GTTGGTTCATGTGCAGTAAG), respectively. Amplification conditions were as described above for the 0.35-kb product and sequencing was carried out on an ABI PRISM 377.

Statistical analyses

Microsatellites

Polymorphism within management groups (EEP, SSP, SA — South Africa, UAE) and overall in the entire captive population, measured as the total number of alleles, mean number of alleles per locus, and mean observed heterozygosity was calculated using genepop (Raymond & Rousset 1995). Allelic richness estimates were made using fstat (Goudet 2001). Tests for deviation from Hardy–Weinberg expectations and genotypic linkage disequilibrium were performed in genepop followed by sequential Bonferroni correction (Rice 1989). Estimates of within-group FIS were obtained using genetix version 4.04 (Belkhir et al. 2003). structure 2.0 (Pritchard et al. 2000; Falush et al. 2003) was used to look for the presence of genetic structure among the samples. This software uses a Bayesian clustering approach to infer the number of populations (K) in a data set without a priori assignment of samples to populations. We used the population admixture model (where each individual is assumed to have inherited a proportion of its ancestry from each population) with correlated allele frequencies among populations. Ten replicates (to check for consistency) were run at each estimated group size (from K = 1 to K = 5) using a burn-in of 50 000 iterations and collection of data over 500 000 iterations. Values for the log likelihood of data across runs and values for individual membership within groups were then evaluated. Posterior probability values were calculated for the maximum log-likelihood value obtained using the formula given in Pritchard & Wen (2003). Pairwise estimates of the coefficient of relatedness (r) for all individuals were calculated using the Lynch & Ritland (1999) measure within the program identix (Belkhir et al. 2002). A recent study found that the Lynch and Ritland estimate (rxyLR) more accurately depicted true relatedness between individuals compared to the Queller & Goodnight (1989) estimate (rxyQG) (Russello & Amato 2004). Pairwise kinship coefficients were calculated as half the pairwise relatedness coefficients (Hardy 2003), and mean kinship (mk) values were then obtained for every individual as the average of pairwise kinship coefficient values to all other individuals including itself (Russello & Amato 2004).

Mitochondrial DNA

Sequences were checked by eye, edited, and aligned using bioedit 5.0.9 (Hall 1999). Numbers of haplotypes, private haplotypes, polymorphic sites, and haplotype and nucleotide diversity were determined using dnasp 4.0 (Rozas et al. 2003). The model of DNA substitution that best fitted the data was selected using modeltest, version 3.06 (Posada & Crandall 1998). The Tamura-Nei + I + ã model [proportion of invariable sites (I) = 0.7786; á = 0.7361] was selected by the Akaike information criterion (AIC). Model selection by the AIC has been reported to offer several advantages over hierarchical likelihood-ratio tests (Posada & Buckley 2004). Sequences were analysed using maximum-parsimony (MP) and maximum-likelihood (ML) approaches in paup, version 4.0b10 (Swofford 2002). A heuristic search with the tree-bisection–reconnection (TBR) branch swapping algorithm with 100 random taxon addition replicates was used in both cases. Node support was assessed using 1000 bootstrap replicates with 10 random taxon addition replicates in the case of MP, and 100 bootstrap replicates with one random taxon addition replicate in the case of ML (due to insufficient computer power). We also used a Bayesian likelihood approach in mrbayes, version 3.1 (Huelsenbeck & Ronquist 2001; Ronquist & Huelsenbeck 2003) using a general GTR + I + G model, allowing mrbayes to estimate the various model parameters. The analysis was carried out using the default setting of four Markov chains (three heated and one cold) for 3 000 000 generations, sampling once every 100 generations. Four separate analyses were carried out simultaneously

starting with different random trees. Post-burn-in trees (22 500) from all four analyses were used to estimate posterior probabilities. A homologous sequence from the Arabian oryx (GenBank: AJ235326) was used as the outgroup in all analyses.

Mean uncorrected p distances between groups of haplotypes were measured in mega version 2.1 (Kumar et al. 2001). Genealogical relationships among sequences were determined by a minimum spanning network using the statistical parsimony method (Templeton et al. 1992) implemented in tcs 1.18 (Clement et al. 2000). The algorithm within this program estimates the 95% statistical confidence limit for the maximum number of nucleotide substitutions between two haplotypes (the parsimony limit) and sequentially connects taxa into networks within this limit. A mismatch distribution of pairwise substitutional differences among haplotypes and a range of neutrality statistics capable of detecting the genetic traces of population growth, decline, or stability, were examined using dnasp version 4.0 (Rozas et al. 2003). Values for Fu's F-statistic (FS, which specifically tests for population growth and detects excesses of low-frequency alleles) and Fu and Li's F* and D* statistics were obtained (Fu 1997). Observed values of FS were compared with values obtained upon 1000 simulations in order to determine 99% confidence intervals. To estimate time since expansion (t), we used the formula ô = 2ut where u = 2µk, where µ is the mutation rate per site per million years and k is the length of the sequence. For estimation of recent population size, we used estimates of theta (è) and the formula è = 2Nefµ, where Nef is the female effective population size and µ is the mutation rate in substitutions/site/generation. This estimate is representative of recent rather than historical population size since genealogical information is not used (Crandall et al. 1999).

Results

Historical demography

Forty haplotypes (two indels considered) were identified among 141 SHO samples upon sequencing the entire control region (Table 1). Sequencing of the smaller 353-bp product from a further 45

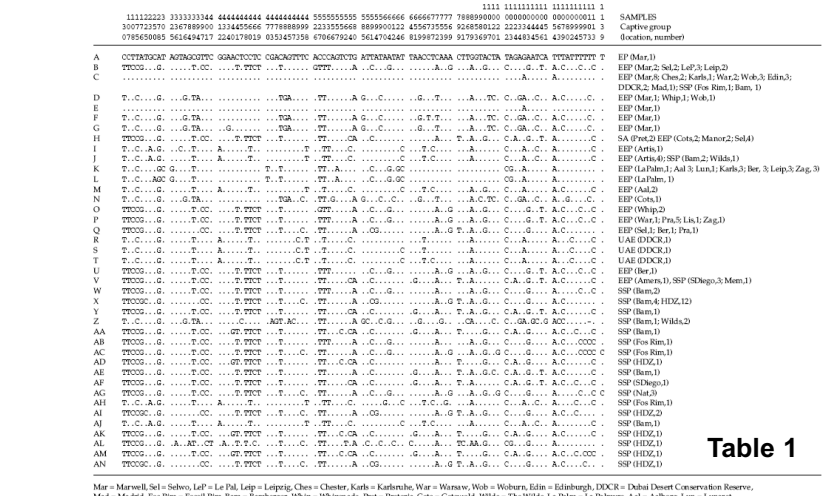

Table 1

Mar = Marwell, Sel = Selwo, LeP = Le Pal, Leip = Leipzig, Ches = Chester, Karls = Karlsruhe, War = Warsaw, Wob = Woburn, Edin = Edinburgh, DDCR = Dubai Desert Conservation Reserve, Mad = Madrid, Fos Rim = Fossil Rim, Bam = Bamberger, Whip = Whipsnade, Pret = Pretoria, Cots = Cotswold, Wilds = The Wilds, La Palm = La Palmyre, Aal = Aalborg, Lun = Lunaret, Ber = Berlin, Zag = Zagreb, Pra = Prague, Lis = Lisbon, Amers = Amersfoort, SDiego = San Diego, Mem = Memphis, HDZ = Henry Doorly zoo, Nat = National zoo. GenBank Accession nos are DQ159406-DQ159415 for haplotypes A-AN.

samples where amplification of the 1.2-kb product was unsuccessful, did not provide additional information. The sequences reported are likely to represent cytoplasmic mtDNA (cymt) and not nuclear copies of mtDNA (numt) because we designed species-specific primers for this study and obtained identical sequences from both blood and tissue samples in a few individuals. A network analysis produced three disconnected networks with 95% confidence (connection limit = 15) indicating deep divergence between haplotypes (Fig. 2). Three unconnected haplotypes were also observed (K-L and AL). Numbers of mutation steps required for connecting haplotypes between the three separate networks and for connecting the unconnected haplotypes are shown in Fig. 2. A minimum of 24 mutation steps were necessary to connect haplotypes between networks. Four most parsimonious trees were produced using maximum parsimony (MP), with topologies very similar to those obtained with maximum likelihood (ML) and Bayesian analyses. A consensus tree is shown in Fig. 3 with MP and ML bootstrap support values and Bayesian posterior probabilities.

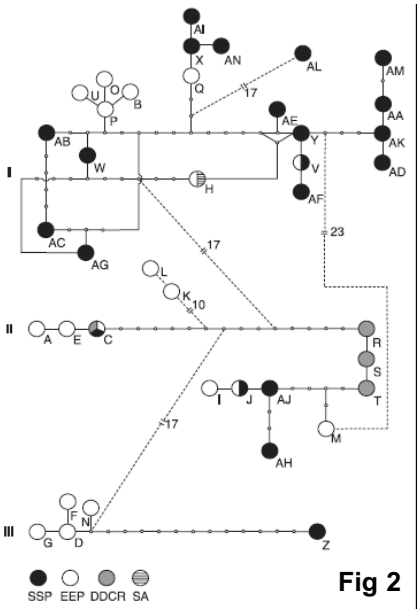

Fig 2

Haplotypes within networks I and III were found to group together with fairly high bootstrap and posterior probability values, but network II haplotypes grouped into two separate clades (A, E, C) and (I, J, AH, AJ, M, R, S, T). Mean uncorrected p distances between haplotypes in networks I and II, I and III, and II and III were 2.62%, 2.35%, and 3.01%, respectively. From a previous study on the characterization of the control region in Oryx species (Iyengar et al. 2006), a mean divergence rate for the entire sequence was estimated to be approximately 1.13% per million years. Using this estimate, divergence times of c. 2.3 million years between networks I and II, 2.1 million years between networks I and III, and 2.7 million years between networks II and III were obtained.

A mismatch distribution of pairwise differences among all haplotypes did not show a unimodal pattern which is generally interpreted as a signature of population expansion (Rogers & Harpending 1992). Instead, it showed a multimodal, erratic ('ragged') pattern. Similar patterns were obtained when haplotypes from networks II and III were analysed independently (haplotypes K,L excluded from network II, data not shown). However, when samples from network I alone were analysed (haplotype AL excluded), the mismatch distribution fitted a unimodal curve with a low raggedness statistic ($r = 0.012$, $P < 0.05$) (Fig. 4). A test for Fu's F_S, a powerful test for population expansion, was found to be highly significant when all haplotypes ($F_S = -19.22$ (99% CI: -14.87–3.49) or network I haplotypes alone were analysed (haplotype AL excluded) ($F_S = -14.16$, 99% CI: -8.00–9.06), nonsignificant when network II haplotypes alone were analysed (haplotypes K,L excluded) ($F_S = -2.57$, 95% CI: -4.24–4.33), and very marginally significant when network III haplotypes alone were analysed ($F_S = -0.51$, 95%CI: -0.48–4.43). A significant value of F_S rejects population stasis/neutrality indicating an excess of recent mutations, and thus, popula-

tion expansion and/or selection. Range expansion can be distinguished from the effects of selection by the patterns of significance of F_S, F* and D* (Fu 1997). A range expansion is indicated when F_S is significant and F* and D* are not, while the reverse suggests selection. Nonsignificant values were obtained for F* and D* when either all haplotypes, network I haplotypes, or network II haplotypes were analysed, but a marginally significant value for D* (-1.24, $P < 0.05$) and a nonsignificant value for F* were seen in the case of network III haplotypes. Estimates of time since expansion were generated from the mismatch distributions for network I haplotypes and for all haplotypes, resulting in values for ô of 5.76 and 12.90, respectively. Using the average mutation rate of 1.13% per million years for the control region sequence, and an estimated generation time of 5 years for SHO, time since expansion was calculated to be approximately 0.5 million years ago (Ma) and 1.2 Ma for network I and all haplotypes, respectively.

In order to obtain some idea of the recent population size of SHO in only the 5' variable section of the control region was considered, this value rose to 2.22%. Four haplotypes were found to be shared between captive groups: haplotype C, widespread among EEP individuals, was also seen within UAE and SSP samples; haplotype H was found in both EEP and SA groups; and haplotypes J and V were found in both EEP and SSP groups (Table 1, Fig. 2). While haplotypes from all three networks were represented in the SSP group, the majority of network I sequences (15/22) were found within this group. The highest uncorrected p distance values were seen between haplotypes AK and Z, AA and Z, and AM and Z (3.63%, 3.71%, and 3.79%, respectively), all found within the SSP group. A number of haplotypes representing all three divergent networks (X, W, AE, Y, and AA from network I, C, J, and AJ from network II, and Z from network III) were detected within Bamberger Ranch in Texas, USA. Both haplotypes AA and Z showing one of the maximal p distance values were found within Bamberger. Another large ranch in Texas (Fossil Rim) was found to contain haplotypes spanning two networks (AB and AC from network I, and C and AH from network II). Within HDZ, although only network I haplotypes were detected (X, AI, AN, AL, AM, AK, AD), the majority (all except X) were found to be unique to individuals from this zoo. Haplotypes from across all three networks were also found in the EEP group but network I haplotypes were underrepresented. Haplotypes E and D were found in the two individuals translocated to Australia from Marwell zoo in 1987. Haplotypes K and L, which were disconnected to the rest of the networks, were found in several individuals, including two individuals sent in 1999/2000 to Sidi Toui National Park, Tunisia, from La Palmyre Zoo, France, as part of a reintroduction programme (Table 1). UAE samples consisted of three closely related haplotypes R, S, and T, and one slightly more distant haplotype, C, which was shared with both EEP and SSP groups. Only one haplotype (H) was found between two individuals from Pretoria Zoo and was shared with individuals from the EEP group.

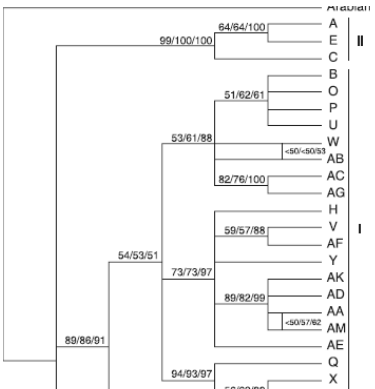

Fig 3

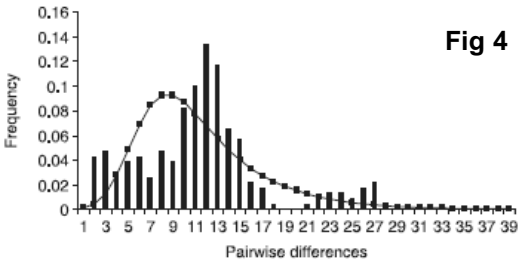

Fig 4

Current microsatellite diversity in captive groups

We successfully amplified six microsatellite loci in 106 out of 147 faecal samples (72%). Thirteen repeat samples were identified from the multilocus genotypes obtained and were deleted, leaving 93 samples for all analyses. One locus each within the EEP and SSP group (MAF46 and FCB304, respectively) was found to deviate significantly from Hardy–Weinberg equilibrium after Bonferroni correction. Both loci demonstrated heterozygote deficits but since the same locus was not found to consistently deviate across both groups, this is not thought to be a consequence of null alleles. Tests for linkage disequilibrium after Bonferroni correction revealed one association that remained significant (OarCP26 and MAF50). Both loci, mapped to sheep chromosome 4, are separated by 30 cM (http://www.thearkdb.org/, Roslin Institute), a distance considered adequate to ensure linkage equilibrium by some authors (e.g. Luo et al. 2004). However, given the significant result, we eliminated locus MAF50 from all analyses.

Total number of alleles, number of private alleles, allelic richness, average allelic range in repeat unit length and average heterozygosity were all once again, higher in the SSP than in the EEP group (Table 2). To check that this was not an effect of sampling large numbers of related individuals within the EEP group and not in the SSP group, we deleted one individual out of every known full-sib and parent–offspring relationship from both groups and re-analysed the remaining data (EEP n = 102; SSP n = 43). All values remained identical in both data sets (data not shown). The very small sample sets of SA and UAE showed much lower values for all these estimates but clearly require additional sampling. Within-group estimates for the inbreeding coefficient, FIS, revealed the lowest value in the SSP group (0.020), with moderate levels in the EEP group (0.128).

The results obtained using structure 2.0 are summarized in Table 3. Results were highly consistent across the 10 independent repeat runs suggesting adequate numbers of iterations. The highest estimated log-likelihood value (in 10 runs) and the highest posterior probability (0.9991) was seen in the case of K = 3 and there was evidence of differential clustering of EEP and SSP samples, with the majority of SSP samples clustering separately to a large proportion of the EEP samples with > 75% assignment. However, overall proportions assigned to groups were fairly symmetric (1/K in each group) suggesting that there was no support for strong genetic structure across the sample set (Pritchard & Wen 2003). The FST value between EEP and SSP groups was also low, at 0.047 ($P < 0.001$).

Individuals important to global captive breeding based on mk values.

Values obtained for mk in every individual were ranked from lowest to highest in order to prioritize the genetically most important animals, that is, those with the lowest mk values (Fig. 5). Almost all (44/48, 92%) SSP individuals had mk values lower than the median, while the majority (81/120, 68%) of the EEP individuals had mk values higher than the median. The UAE and SA samples fell on both sides of the median, with 4/6 lower and 2/6 higher than the median in the case of UAE and 2/4 lower and 2/4 higher than the median in the case of SA, respectively. The two genetically most important living animals were from Bamberger and possessed four of the eight SSP private alleles. Three SSP private alleles were found in six individuals from HDZ (ranked 2nd, 13th, 25th, 28th, 31st, and 38th). Fifteen of the HDZ individuals sampled were dead (marked with asterisks in Fig. 5), a number of which have produced no offspring (8th, 13th, 22nd, 28th, 45th, 55th). In Fossil Rim, three of the SSP private alleles were found in two individuals (ranked 14th and 44th). One individual from Fresno (ranked 7th) and two individuals each from San Diego and The Wilds (ranked 5th and 20th, respectively) had one SSP private allele each The highest ranked EEP individuals were from Selwo Zoo, Spain (4th), and Artis Zoo, Holland (11th), followed by the two animals sent to Sidi Toui from La Palmyre (18th and 23rd, respectively).

Discussion

Inferences on historical patterns of demography

Deep sequence divergence between the SHO mtDNA haplotypes was evident by the three disconnected networks, suggesting historical population isolation. Estimated divergence times between the networks ranged from c. 2.1–2.7 million years. These levels of divergence are likely to represent remnants of ancient divergence within SHO, since the genus Oryx along with a number of other arid-adapted bovid species first appear in the fossil record c. 2.7–2.5 Ma (Vrba 1995; Bobe & Eck 2001; deMenocal 2004), and molecular phylogenetic studies support a recent divergence of this genus within the Hippotragini tribe, with all three species consistently found as terminal taxa with very short branch lengths (Gatesy et al. 1997; Hassanin & Douzery 1999; Iyengar et al. 2006).

Significantly large negative values for Fu's FS were obtained both when all haplotypes were analysed simultaneously, and when network I haplotypes were analysed separately. In addition, nonsignificant values for Fu and Li's F* and D* were seen in both these cases, a pattern that is highly suggestive of an ancient population expansion. A unimodal pattern of mismatch distribution characteristic of a population explosion was however, not observed when all haplotypes were considered. Results from a mismatch distribution are sometimes considered tentative since a number of factors such as the time of population expansion, population size before expansion, and subdivision of populations, have been found to affect the results (Marjoram & Donnelly 1994). It is possible that both population subdivision (clearly apparent from the three disconnected networks), and population size before expansion, are responsible for this observation. In the case of network I haplotypes however, a mismatch distribution showing a unimodal pattern was supported by a significantly low raggedness statistic (Harpending 1994).

Times of population expansion were estimated to be c. 0.5 Ma and c. 1.2 Ma with network I or all haplotypes, respectively.

	EEP	SSP	SA	UAE	TOTAL
Mt Dloop haplotypes (1188nt)					
Sample size	86	48	2	5	141
No. of haplotypes	19	21	1	4	40
No. of private haplotypes	15	18	0	3	–
No. of polymorphic sites (% variation)	72 (6.1)	82 (6.9)	0	17 (1.4)	99 (8.3)
Haplotype diversity (SD)	0.880 (0.018)	0.875 (0.040)	0	0.900 (0.161)	0.926 (0.01)
Nucleotide diversity (SD)	0.017 (0.0004)	0.015 (0.0019)	0	0.008 (0.002)	0.018 (0.0005)
Microsatellites					
Sample size	120	48	4	6	178
Total no. of alleles	27	35	11	9	82
No. of private alleles	0	7	0	0	–
Allelic richness	2.92	3.34	2.20	1.71	–
Average no. of alleles/locus	5.4	7.0	2.2	1.8	16.4
Observed heterozygosity (%)	54	57	32	27	42
Average range	6.2	8.0	3.4	4.0	8.0
F_{IS} (95% CI)	0.128 (0.065–0.185)	0.020 (−0.082–0.101)	0.348 (−0.500–0.600)	0.222 (−0.250–0.390)	0.134 (0.083–0.179)

SD, standard deviation; average range, average range of allele size expansion in repeat motif number.

Table 2

There is considerable evidence to suggest that glaciation events caused severe climatic changes within Africa. Throughout the Quaternary period which was dominated by ice ages that occurred every 41 000 years until 0.9 Ma, and every 100 000 years thereafter, it has been found that during glacial cycles, the climate was colder and drier in Africa with an increase in savannah and desert regions and a reduction in rainforests (e.g. deMenocal 2004; Hewitt 2004a). Studies have shown that at the last glacial maximum (LGM) c. 23 000–14 500 years ago, increased aridity in Africa resulted in the expansion of the Sahara desert zone hundreds of kilometre further south than at present, compressing the Sahelian zone equator wards (Thomas & Thorp 1995). However, other studies have found that at this time, areas in the northwest of the Sahara

Table 3 Results from STRUCTURE 2.0 for K values 1–5. The highest Ln $P(X/K)$ obtained in 10 independent runs, mean inferred assignment to clusters, and numbers of individuals with > 75% assignments within each cluster are shown

K	Ln $P(X/K)$	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
1	−2099.8					
2	−2035.8	0.454 (10EEP,36SSP,3UAE)	0.546 (73EEP,1SSP,1UAE,2SA)			
3	−1982.8	0.321 (2EEP,29SSP,1UAE)	0.338 (30EEP,1SSP,2UAE)	0.343 (37EEP,1SSP,4UAE)		
4	−1990.2	0.266 (20EEP,1UAE)	0.291 (25EEP,1SA)	0.205 (3EEP,5SSP)	0.238 (15SSP,1UAE)	
5	−2038.0	0.208 –	0.192 –	0.209 –	0.208 –	0.184 –

Table 3

retained greater winter rainfall and consequently formed a belt of semidesert to the south of the present day desert margin (Hooghiemstra et al. 1992). Even in the central part of the Sahara, areas above 1500 m are thought to have resembled semidesert at the LGM since evidence suggests that winter rainfall occurred in these

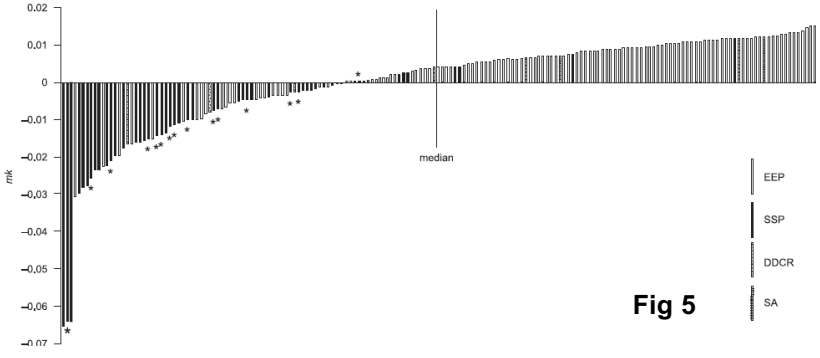

Fig 5

regions and maintained scattered vegetation (Maley 2000). Although many phylogeographical studies of large mammals across Africa have found evidence for the existence of glacial refugial areas within the west, east, and south of the continent (reviewed in Hewitt 2004b), there are very few studies that have investigated

the evolutionary history of the fauna and flora of North Africa. Unsurprisingly, however, these studies have also found genetic evidence for conspicuous palaeoclimatic effects in this region (Brown et al. 2002; Cosson et al. 2005).

We propose therefore, that the population expansion signals detected at 1.2 Ma and 0.5 Ma in SHO are the result of the restriction of populations within suitable refugial areas during glacial cycles followed by expansion during favourable interglacial conditions. Since evidence already suggests that suitable semidesert habitat was available to the north and the south of the Sahara, and possibly even within the Sahara itself at higher altitudes, SHO populations may have become restricted into three or more such refugial areas during an ancient glaciation, resulting in the three divergent networks that are seen. A star-shaped topology characteristically seen when populations have undergone rapid range expansion following restriction into small refugia as seen in many species from temperate regions (e.g. Hull & Girman 2005) was, however, not seen in the networks. Perhaps refugial areas in this region were large, retaining sizeable numbers of diverse ancestral haplotypes. In this case, small numbers of ancestral haplotypes expanding into new haplotypes would then reveal small groups of star-shaped topologies as seen in network I (e.g. P, B, O, and U). Since all the samples used in this study are most likely to have originated from just one location (Chad), we are unfortunately unable to obtain a more complete picture of the various phylogeographical groups that may have existed, and an extensive survey of museum samples will prove useful in this context.

Following the ice ages, in the early part of the Holocene (9500–4500 years ago), there is extensive evidence to suggest that conditions were much more humid in the Sahara than it is at present ('the early Holocene pluvial episode'), with savannah extending right into the desert. Relict savannah plant species have been found in the Sahara and rock art left by early humans in the area suggest the existence of savannah species such as elephants and hippos during this time (e.g. Lézine 1989; deVivo & Carmignotto 2004). Thus, having undergone repeated population restriction and expansion during glacial cycles, the existence and maintenance of enormous numbers of SHO across North Africa in the past few thousand years is highly possible, providing support for the census estimate obtained in this study of c. 1 million individuals in the recent past. SHO was considered the most numerous large mammal of the Sahel during the middle ages, and as recently as 1936, herds of up to 10 000 animals were sighted in Chad (Bassett 1975; Newby 1988). High levels of genetic diversity must have been maintained within SHO populations since they were migratory, travelling large distances (over 600 km annual round trip recorded in Chad) in search of grazing (Newby 1988).

Genetic diversity preserved within captive groups

The SSP group was found to retain higher levels of genetic diversity with both mtDNA and microsatellites, reflecting the greater number of founder individuals taken to the USA from the initial captures made in Chad. Overall mean uncorrected p distance across all SHO haplotypes was 2.0%, a value that is comparable to those reported within other Hippotragines (1.9% in roan, Alpers et al. 2004) and the closely related Alcelaphines [1.7% in topi *(Damaliscus lunatus)*, 2.4% in wildebeest *(Connochaetes taurinus)*, Arctander et al. 1999]. However, the maximal levels of divergence between haplotypes reported in other Hippotragines are far greater than those seen in SHO. For example, in sable, Pitra et al. (2002) observed a mean sequence divergence of 14.6% between three clades representing regions in eastern and southern Africa, and in roan, Alpers et al. (2004) observed a maximal divergence of 27.5% between two haplotypes from Senegal and Botswana. In this study, a mean divergence of only 2.7% was observed between the three SHO networks with a maximum value of 3.8% between haplotypes AM and Z. Therefore, given that SHO spanned across vast areas of North Africa, and that populations may have become isolated into ice age refugia resulting in highly divergent groups of haplotypes (networks), it appears that some of the range of diversity may have become lost. The detection of a novel transition within the museum sample from Sudan (1911) provides some evidence for the existence of greater diversity in the past, but more extensive sampling is required in order to elucidate historical patterns.

The lack of strong evidence for population genetic structure using microsatellites could be a result of the small number of loci used in this study since Evanno et al. (2005) have reported a drop in detection of signal of population genetic structure with five loci in comparison to 10 loci. However, other studies have successfully detected evidence for population structure using just five microsatellite loci (Pritchard et al. 2000; Hufbauer et al. 2004). Consequently, we interpret our finding of a lack of population structure as being a result of very large numbers of SHO existing largely in panmixia within the Sahelian region after the early Holocene pluvial episode. SHO are thought to have been highly nomadic, travelling vast distances on a regular basis (Newby 1988; Wacher 1988). Mean observed microsatellite heterozygosity in SHO across all groups was identical to that seen in wild populations of roan (42%, Alpers et al. 2004), and values seen within the SSP and EEP groups (57% and 54%) were very similar to that seen in captive populations of Arabian oryx (54% across six loci, four of which were the same as those used in this study) (Marshall et al. 1999).

Future captive breeding and reintroductions

Information from the SHO stud book database containing multigenerational captive breeding records suggests that the sample set used in this study includes, albeit to varying degrees, 80% and > 85% of the original founder lineages from the SSP and EEP groups, respectively (data not shown). Future captive breeding must maintain and actively manage the high levels of genetic diversity seen within the SSP group. Results suggest that Bamberger, HDZ, and Fossil Rim hold some of the most valuable global SHO genetic diversity. Demographic studies on SHO within the SSP has revealed an ageing population where far greater numbers of older rather than younger individuals are being held, and breeding is inadequate (also indicated by the very low FIS value seen within SSP in this study), and it has been recognized that managed captive breeding is urgently required (Spevak 2004). Results from this study further highlight this need. Loss of some genetic diversity is already apparent in HDZ where a number of dead individuals of genetic importance have left no known progeny. Within the EEP group, although levels of overall genetic diversity are lower, mtDNA haplotypes from all networks are represented (except for a degree of under-representation of network I haplotypes), and levels of microsatellite allelic richness are high. Also, large numbers of younger individuals are held as a result of sustained managed captive breeding, rendering the population more 'stable' in the long term (Gilbert 2005). Although small sample sizes in the UAE and SA groups preclude conclusions, it is clear that management programmes running within individual countries need to keep in mind the requirement for

animal import from other regions in order to prevent extensive inbreeding. Since all Australasian SHO are likely to have descended from a few individuals from Marwell, for example the two animals sampled in this study which had common EEP haplotypes and high mk values (ranked 147th and 149th), there is a need for future animal import from both within and outside the EEP into these regions. Two SHO sent to Sidi Toui National Park as part of 18 individuals sent from the EEP to various parks in Tunisia, possessed distinct haplotypes and low mk (ranked 18th and 24th), making them important in a global context. Studbook information indicates that the remaining animals sent to Tunisia are related at

Scimitar-horned oryx at Ferlo National Park, Senegal

varying degrees to other animals held within the EEP. It is of interest to carry out further genetic analyses on these reintroduced animals and on animals to be re-introduced in the future in order to establish how best to maintain and supplement genetic diversity in these groups.

In conclusion, based on our findings, we recommend that a 'global' perspective for the captive genetic management of SHO is maintained, and that individuals across networks continue to be intermixed as currently practised. Individuals from various management programmes and regions need to be effectively utilized for sustained future captive breeding in order to ensure that the vital remnants of genetic diversity are retained and represented in future reintroduction programmes.

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The Uganda kob of Murchison Falls NP: white-eared kob in disguise

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Subspecies are often geographically and morphologically well-defined, and genetically discernable. Three subspecies of kob antelope are recognised based on distribution range and male coat colour (see figure). Buffon's kob in west Africa and Uganda kob in central Africa are physically identical and mature males are brown, and both subspecies are considered conservation dependant. Mature males of white-eared kob are ebony coloured. The subspecies, found in Sudan and Ethiopia, is migratory, and is considered near threatened.
Genetic data can aid in the identification of distinct subspecies, populations or units for conservation and management. The data also provides important insights into species evolutionary histories and historic migration patterns. Using a combination of genetic markers, we analysed ten kob populations sampled across the northern savannah plains of equatorial Africa (see figure).

Genotype and phenotype differ in Murchison Falls NP

In Uganda, the kob constitutes the most numerous antelope in the three main conservation areas it is restricted to; in and around Queen Elizabeth National Park, Semliki Wildlife Reserve and Murchison Falls National Park. No major geographical barriers separate Murchison in northern Uganda and Queen Elizabeth in the south. Due to their geographic proximity and similarities in life history traits and phenotype (physical appearance), both populations are classified as Uganda kob. Surprisingly, our genetic data revealed the populations to be highly genetically differentiated.

Rather, Murchison kob genetically resembled white-eared kob to a high degree, and we found a deep genetic split between Buffon's/Queen Elizabeth kob and Murchison/white-eared kob. Murchison and white-eared kob differ not only physically, but also in life history traits; over 800,000 white-eared kob annually migrate 1,500 km between southeastern Sudan and northeastern Uganda. Migration is a successful strategy for coping with resource scarcity in highly seasonal environments, and the circular movements of white-eared kob are correlated with fluctuations in food and water availability. Although the last thirty years of civil war has disrupted

the pattern somewhat and the migration no longer reaches Uganda, it still rivals that of the great herds of the Serengeti plains in East Africa, and animals aggregate at densities of up to 1,000 individuals/km^2.

Unlike white-eared kob, Murchison kob do not migrate. Their sedentary behaviour is due to locally finite resources, as the higher rainfall of the region ensures access to permanent water and green pastures all year round. This is reflected in the differing reproductive behaviour of kob in Uganda and white-eared kob; Ugandan kob breed perennially in leks, whereas white-eared kob are seasonal breeders and breed in leks while on the go. The considerable mixing of genes anticipated during the migration was reflected in the genetic similarity of the sampled white-eared kob populations.

The kob populations in Queen Elizabeth NP are genetically depauperate

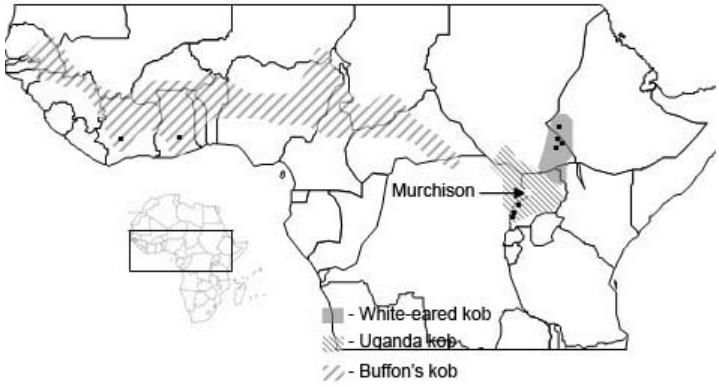


Figure Map of sampling localities (black dots) and the described distribution boundaries (shaded areas) of the three kob subspecies. Murchison Falls National Park in Uganda is indicated.

The kob in Queen Elizabeth had very low levels of genetic variation. Previous research reported similar reduced genetic variation in warthog and elephant in the park. This could be due to Uganda's political regime in the 1970's, which caused an unprecedented wave of poaching in the country's national parks. The kob was particularly susceptible to poaching due to the ease with which it is hunted for meat.

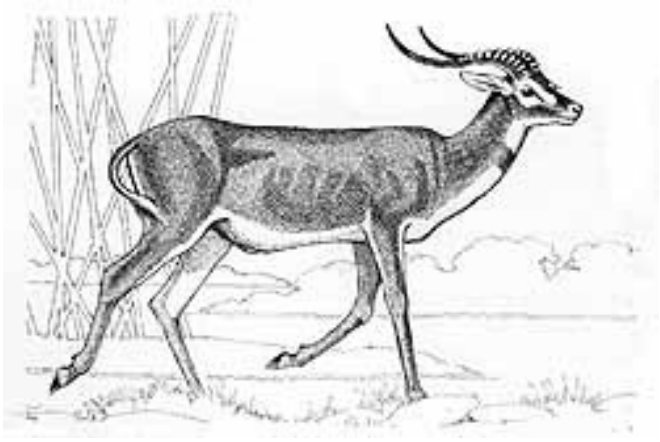
However, there was no statistical support for such a scenario in any of the sampled Ugandan parks. Either i) the demographic bottleneck—whereby a population is reduced in size, like wine being poured from a bottle—was not reflected in a corresponding genetic bottleneck, or ii) the bottleneck was not as severe as it was believed to be. The latter was supported by IUCN antelope surveys, which reported that kob in Queen Elizabeth reduced from 12,000 to 7,000 in the late 1970's, and subsequently increased.

In contrast, a high level of genetic variability was found in Murchison. The population in the southern section of the park is reported to have increased 6–7 folds from 1,600 between 1967 and 1980. This further argues against a severe human induced bottleneck in Uganda. Alternatively, the political instability of the country may not have affected its national parks and wildlife reserves to the same degree.

Historical migration patterns and taxonomic considerations

The cycles of glacial advance and retreat characteristic of the Pleistocene (1.0–0.1 MYA) have influenced community histories across the planet. Refuges with persistent habitat are believed to have existed during the climatic fluctuations of the period, profoundly influencing the development and divergence of African antelope.

The deep genetic split found between Buffon's/Queen Elizabeth kob and Murchison/white-eared kob suggested a period of isolation during which the two groups diverged. We propose the groups survived unfavourable periods of the Pleistocene in refuges in west and east Africa, respectively. The ecological, physical and genetic distinctiveness of white-eared kob in Sudan and Ethiopia reflected its isolation in an east African refuge. An east African refuge has similarly been proposed for hartebeest, topi and roan. The population which survived in a west African refuge dispersed north of the Ruwenzori Mountains into East Africa after a period of isolation. The low genetic variability of Queen Elizabeth suggests the founding population from west Africa was small.

When the east African refuge population subsequently dispersed southwards during more favourable times, it came into contact with kob in northern Uganda. A hybrid zone between the two genetically distinct groups in the area is supported by the high genetic variability of Murchison. Continuous backcrossing of Murchison individuals with white-eared kob could genetically swamp and mask any mixed ancestry. Our data suggested the migration between Uganda kob (including Murchison) and white-eared kob is ongoing.

As Buffon's and Uganda kob are physically indistinguishable, display similar life history traits, and share a common genetic background, we call into question their current taxonomic status as separate subspecies.