GNUSLETTER

Volume 38 / Numbers 1&2
December 2021

ANTELOPE SPECIALIST GROUP

IUCN Species Survival Commission
Antelope Specialist Group

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

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

The Antelope Specialist Group Program Office is hosted and supported by Marwell Wildlife

https://www.marwell.org.uk

The designation of geographical entities in this report does not imply the expression of any opinion on the part of IUCN, the Species Survival Commission, or the Antelope Specialist Group concerning the legal status of any country, territory or area, or concerning the delimitation of any frontiers or boundaries. Views expressed in *GNUSLETTER* are those of the individual authors,

Front Cover. *Formerly extinct in the wild, Scimitar-Horned Oryx are now on the road to recovery, Ouadi Rime Ouadi Achim Game Reserve, Chad, 17 November 2021 (© John Newby / Sahara Conservation Fund)*

GNUSLETTER Volume 38 Numbers 1&2 December 2021

From IUCN and ASG

The Antelope Specialist Group lost its founder, Richard *Dick* Estes, a pioneer of antelope conservation

Jeremy Anderson

ASG members will be saddened to learn that on the 6th December, at the age of 93, Richard "Dick" Estes died at his home in New Hampshire. He was certainly one of the giants of that era in the 1960s when the doors to the ecology and behavior of Africa's fauna were being unlocked and opened.

Dick started his career in wildlife in 1959-60 as co-leader of IUCN Wildlife Survey in Burma and he then completed a PhD on the behavior of wildebeest in the Ngorongoro crater and Serengeti. This was when he met his wife Runi. He followed this study with work on sable antelope from 1968-1970 and he and Runi spent over a year in Angola working on the giant sable.

He helped form the IUCN's SSC Antelope Specialist Group in 1978 and for many years was its first Chair. He was also the editor of the ASG's "*Gnusletter*" from 1980 to 2005.

He published prolifically and will be best remembered for his books *The Behavior Guide to African Mammals* and *Safari Companion* which made so much valuable information available for everyone with an interest in Africa mammals. His last book was *The Gnu's World* and nobody knew their world better than the '*Gnu Guru'*.

One of his last trips to southern Africa was in 2009, when Pedro vaz Pinto led the successful operation with Dr Pete Morkel to capture the last few giant sable in Cangandala National Park for the planned *in situ* breeding project. Then over 80, he would still go for a run each day, a feat which a younger member of the group briefly tried to emulate. Others resorted to wisecracks, to which he always had a pithy riposte.

Though Tanzania was perhaps his spiritual home, his frequent visits to South Africa were relished by his wide circle of friends. He was always ready to share his knowledge and enthusiasm with younger wildlife conservationists and whenever he attended an Antelope Specialist Group meeting in South Africa, it was sure to take much longer than planned, as he became absorbed in the work and issues of local members. In doing so he became a mentor to many.

He left a deep spoor across the pages of Africa's wildlife landscapes, and it will be a good one to follow. We extend our deepest sympathy to his family, Runi, Anna and Lyndon.

In Memoriam: Ali Laouel Abagana

Hamissou Halilou Malam Garba – Deputy Director of Wildlife and Protected Areas in Niger
Julian Fennessy – Giraffe Conservation Foundation (GCF) Co-Director & Co-Founder
Thomas Rabeil – Wild Africa Conservation (WAC) Executive Director & ASG member

Colonel Ali Laouel Abagana from the Ministry of Environment in Niger has passed away suddenly although he was only 51 years old. He had just been accepted as member of the Antelope Specialist Group. Ali has dedicated his career to saving wildlife in Niger, from the Arabian bustard to the West African Giraffe. He was instrumental in the reintroduction of giraffes into Gadabedji Wildlife Reserve, and he contributed a lot to improving knowledge of the last populations of wild addax and dama gazelle in Niger.

Ali was a keen field biologist. He spent many days trekking in the rocky mountains of the Aïr and Termit massifs collecting data on the critically endangered dama gazelle. Ali also surveyed a huge number of sandy areas in the Tin Toumma desert and the Erg of Bilma looking for addax, the rarest antelope in Africa. He was also an accomplished researcher and was finalizing a thesis on the socio-ecology and human dimensions of giraffes in Gadabedji.

Ali was not only a good field biologist but also a fierce defender of endangered species. As Niger representative at CITES and CMS conferences of parties, Ali successfully advocated for the conservation status of the African lion, elephant and giraffe.

Ali was remarkable due to his genuine faith in wildlife conservation and was therefore a leader for many young African conservationists. This is a terrible loss for the antelope and giraffe conservation community, and we would like to express our deep condolences to his family, friends and colleagues. Ali leaves an enormous void but his successes and his smile will serve as an inspiration for us to keep moving forward, and for the next generations.

ASG at IUCN World Conservation Congress: Motion 102

Philippe Chardonnet

The Antelope Specialist Group (ASG), the Wildlife Health Specialist Group (WHSG) and the USA-based NGO EcoHealth Alliance have long been concerned about the problem of the massive expansion of livestock worldwide. In 2019, it was decided to submit a Motion on this issue to the forthcoming IUCN World Conservation Congress (WCC) initially planned in 2020. EcoHealth Alliance offered to be the proponent of the Motion. The content was first elaborated between EcoHealth Alliance, the WHSG and ASG, then discussed and amended with the co-sponsors of the Motion (Table 1). The Motion was officially submitted to WCC under the title: "Strengthening mutual benefits of livestock & wildlife in shared landscapes" (https://www.iucncongress2020.org/motion/102/57751 Table 2) and it was accepted and passed by more than 90% of the voting IUCN members.

Table 1. *Co-sponsors of Motion 102*

AFRICA
Association Marocaine pour la Protection de l`Environnement et le Climat [Morocco]
Association de Gestion Integrée des Ressources [Morocco]
Association intervillageoise de Gestion des Ressources Naturelles et de la Faune de la Comoé-Léraba [Burkina Faso]
Club Marocain pour l'Environment et le Développement [Morocco]
Conservation Through Public Health [Uganda]
NORTH AMERICA
EcoHealth Alliance [United States of America]
Sahara Conservation Fund [United States of America]
San Diego Zoo Global [United States of America]
SOUTH AMERICA
Fundación Ambiente y Recursos Naturales [Argentina]
Fundación Biodiversidad [Argentina]
EUROPE
European Bureau for Conservation and Development [Belgium]
Leo Foundation [The Netherlands]
Marwell Wildlife [United Kingdom]
The Born Free Foundation [United Kingdom]

Motion 102 recognises the critical importance of livestock and livestock herders for a wide array of reasons including social, cultural, economic, livelihood, food security, poverty alleviation, and even biodiversity conservation in some instances. However, Motion 102 is very much concerned by the continuous and massive expansion of livestock - both demographic and geographic - with many severe consequences, e.g., growing health challenges, livestock encroachment into natural habitats, invasion of Protected Areas, landscape conversion, mega-fires, conflicts with large carnivores etc.

ASG applied to WCC to organise an event to promote Motion 102 with the proponent and the co-sponsors. The IUCN French Committee (https://uicn.fr/) kindly offered a space and time slot to host the event which took place on 7th September 2021. The event started with a presentation of the Motion by Philippe Chardonnet, then three supporters presented their own experiences and with case studies:

- Violeta Barrios, Program Manager, Sahara Conservation Fund
- Mamadou Karama, Executive Director, AGEREF Comoé-Léraba
- Brahim Haddane, IUCN/SSC Steering Comittee Member

A debate among the participants ended the event. It provided evidence of the abundance, variety, and magnitude of the concerns associated with livestock expansion.

Table 2. *Motion 102*

102 - Strengthening mutual benefits of mobile pastoralism and wildlife in shared landscapes

OBSERVING that many extensive landscapes throughout the world are shared by livestock and wildlife, and managed by livestock herders and wildlife managers;
FURTHER OBSERVING that the world livestock herd is continuously increasing whereas biodiversity as a whole, and wildlife in particular, are on the decrease;
NOTING the critical socio-economic and cultural importance of pastoralism for many local communities;
FURTHER NOTING the vital importance of such landscapes for the conservation of biodiversity, especially many species of large herbivores and their predators;
RECOGNISING the potential for ecological compatibility between certain livestock husbandry practices and wildlife;
FURTHER RECOGNISING that local communities, livestock and wildlife share common health risks and health status;
CONCERNED that the interface between livestock and wildlife, and between livestock herders and wildlife managers, is often a source of challenges such as competition for space, water and pasture, potentially leading to overgrazing, disease spill-over, uncontrolled fires, wildlife poaching, etc.;
FURTHER RECOGNISING that the health of pastoral communities, livestock and wildlife share similar resource requirements and that livestock and wildlife share some common health risks;
FURTHER CONCERNED that extreme weather and climate events, along with changing land use and other drivers of ecosystem degradation, may worsen the common sanitary risks for domestic and wild animals and humans, thus enhancing the need for a coordinated, multisectoral One Health approach;
FURTHER CONCERNED that negative interferences between livestock and wildlife on one side, and livestock herders, agriculturists, and wildlife managers on the other side, may have direct and indirect detrimental consequences for biodiversity; and
FURTHER CONCERNED that these detrimental effects will reduce the ability of wildlife-based activities to contribute sustainably to the economy and human well-being;

The IUCN World Conservation Congress, at its session in Marseille, France:

1. INVITES governments in countries where livestock and wildlife share the same landscapes to:
a. promote cohabitation between livestock and wildlife, and collaboration between livestock herders and wildlife managers;
b. establish strategies supporting both livestock development and wildlife conservation together;
c. promote the One Health approach in landscapes shared by humans, livestock and wildlife, for more efficient and coordinated protection of a common sanitary status; and
d. consider establishing early warning and monitoring systems on sanitary consequences of extreme weather and climate events and land-use changes;
2. ENCOURAGES the livestock sector to:
a. consider the maintenance of viable wildlife populations positively in livestock development activities and plans;
b. involve wildlife managers in livestock development activities; and
c. collaborate with wildlife managers to minimise sanitary risks shared by humans, livestock and wildlife;
3. ENCOURAGES wildlife authorities and wildlife stakeholders to:
a. consider the sustained presence of livestock positively in wildlife conservation activities;
b. involve cattle herders in wildlife conservation activities; and
c. collaborate with livestock herders to minimise sanitary risks shared by humans, livestock and wildlife; and
4. INVITES international agencies involved in livestock-wildlife interactions to:
a. support projects encouraging cohabitation of wildlife in areas with livestock, and collaboration between livestock herders and wildlife managers; and
b. promote policies adopting the One Health approach.

Research and Reports

Chad Update from the Sahara Conservation Fund

John Newby
Sahara Conservation Fund

With contributions and data from Tim Wacher (ZSL), Katherine Mertes (SCBI), Marc Dethier (SCF), Justin Chuven (EAD), Mahamat Hassan Hatcha (DFAP), Stephanie Brien (University of Edinburgh), Jaime Dias (WFC), John Watkin (SCF), Ricardo Pusey (EAD), Caleb Ngaba (SCF), Krazidi Abeye (SCF), Habib Ali (SCF)

Fig 1. *Addax being released into the acclimation pens at the Oryx Base Camp, 16 November 2021 (© John Newby / Sahara Conservation Fund)*

Following a hiatus of almost 18 months, caused by the Covid-19 pandemic, arrivals of scimitar-horned oryx and addax from the Environment Agency Abu Dhabi's Deleika Wildlife Conservation Breeding Center have begun again. On the 8th of November 25 oryx arrived at Chad's Abéché airport by charter flight and were successfully transported to project acclimation pens in the Ouadi Rimé-Ouadi Achim Game Reserve. A week later, the oryx were joined by a batch of 25 addax (Figure 1). The antelopes will be recovering from the long journey and adapting to their new environment until their release into the wild during the month of December. Thanks to decent rainfall, including a couple of late, October showers, pasture in the reserve is still fairly green in many places and should remain so for a few more weeks, giving the newly released animals ideal foraging opportunities.

The latest translocations bring the total number of founder oryx received from Abu Dhabi since March 2016 to 250. Addax founders received since November 2019 number 65. Together with the oryx born in Chad, the new arrivals bring us ever closer to our initial target and milestone of a founder population of 500 secure, free-ranging, adult, breeding individuals. The figure of 500 adult breeding oryx was established as a milestone to measure progress not as an absolute target or objective. The population viability experts that met in Abu Dhabi in 2012 modelled this number from the rather sparse data available at the time. 500 was considered, theoretically, to be the minimum population size needed to survive should unforeseen stochastic events occur, such as disease or prolonged drought. The ultimate goal of the oryx project underway is to restore the species across its historical range. This will require many thousands of animals dispersed across several meta-populations. In the coming months it is hoped to convene a new PVA meeting to revisit the 2012 exercise, but this time based on the enormous amount of new information and data that has been collected since 2016 on population dynamics, behaviour, feeding preferences, breeding, veterinary health, and genetics.

In the first three years, with all released founder oryx satellite collared, we were able to track rising population growth very closely, including the brief set back in the late wet season of 2018, when a local disease outbreak and associated management factors caused a series of losses. Numbers recovered rapidly and since then the project has moved on to a more complex but interesting phase as the proportion of animals fitted with collars diminishes.

With so many oryx now unmarked and widely distributed (some untagged groups have been living 150km north of the release site), overall population estimates are difficult to make without significant margins of error. Depending on how strictly one interprets the available data, current total population size could be as low as 316 or as high as 420. Based on the data we have, adult oryx currently make up around 65% of the overall population. On this basis, reaching a population of 500 breeding adults would require a total population in the reserve of around 770 oryx. Together with those recently received, addax currently number around 90.

Fig. 2. *Scimitar-horned oryx, Ouadi Rimé-Ouadi Achim Game Reserve, Chad, 16 November 2021 (© John Newby / Sahara Conservation Fund)*

As the populations of oryx and addax continue to grow (Figures 2 & 3), it has become necessary to estimate numbers by sample counting methods. With support from the EU-funded Ouadi Rimé-Ouadi Achim Project (POROA in French), a first aerial census of oryx and addax has just taken place. Two hundred oryx were observed during aerial transects flying across the core 2800km^2 survey zone. Ninety-eight of them being within the 12% strip transect samples bands. This neatly illustrates the difficulty of estimating population size in rare and widely distributed animals. Two thirds of the 98 animals in the sample were in one herd some 40km northwest of the release site. It is unlikely that 98 animals represent a fair estimate of 12% of the total

population. Nevertheless, these results, together with analysis currently underway from continuous monitoring of these herds points to very positive survival rates in both founders and wild born calves. The combined information strongly suggests the oryx population is currently in excess of 400. At the other extreme, we know well from satellite tracking and regular ground monitoring that there are at least 80 addax in the sample area, but none of them were seen from the air during the formal survey.

Fig. 3. *Addax, Ouadi Rimé-Ouadi Achim Game Reserve, Chad, 6 November 2021 (© John Newby / Sahara Conservation Fund)*

To ensure that monitoring of the growing and dispersing population of oryx remains feasible, select animals that have lost previous collars (all collars incorporate drop off mechanisms and most only stay on for around 21-24 months) are being captured and re-collared. Of special interest are animals with known social or mobility traits. Over a recent 10-day period, 18 wild adult oryx were darted and reequipped with Vectronic satellite tracking collars (Figure 4). At the same time, blood and other samples were taken for both health and genetic monitoring with the assistance of Chad's *Institut de Recherche en Elevage pour le Développement*, the University of Edinburgh, and the Royal Zoological Society of Scotland.

Fig. 4. *Collaring a sedated oryx, Ouadi Rimé-Ouadi Achim Game Reserve, Chad, 18 November 2021 (© John Newby / Sahara Conservation Fund)*

Prior to reintroduction, the antelope undergo an extensive programme of health screening and vaccinations. The samples recently collected from animals released into or born in Chad will be analysed to investigate whether the health status of the oryx has changed since their release. Of particular interest is the impact of direct and indirect contact with livestock on their

infectious disease burden. The use of faecal samples to monitor health and genetics is also being investigated as this would greatly facilitate ongoing population surveillance. Over the long term, studying the genetic diversity of animals born in Chad may help to improve understanding of genetic adaptation in reintroduced populations and could also feed into population viability estimates.

Fig. 5. *Sixty oryx, part of a herd of 87, Ouadi Rimé-Ouadi Achim Game Reserve, Chad, November 2021 (© Jaime Dias / Wings For Conservation)*

As a prelude to the capture and collaring work and during the first days of the operation, we had Jaime Dias of Wings for Conservation and his Cessna 172 make reconnaissance flights to locate interesting groups of oryx for the capture team to target. This included flights to the far north of the known oryx range within the reserve, over 200 km from the initial release site and right on the edge of the Sahel-Sahara interface. The flights provided opportunities to spot and photograph a herd of 87 oryx as well as a nice group of 11 dama gazelles (Figures 5 & 6).

Fig. 6. *Eleven dama gazelles, Ouadi Rimé-Ouadi Achim Game Reserve, Chad, November 2021 (© Jaime Dias / Wings For Conservation)*

Although the oryx and addax are doing extremely well this year, with 71 and 15 births recorded respectively, the gains brought about by good grazing and enhanced security from illegal offtake are nonetheless threatened by the impacts of the numerous annual bushfires that afflict the area and consume thousands of square kilometres of good grazing. Principal causes are accidental fires from around nomad campsites and homesteads, and the exhaust pipes of heavily laden vehicles that cross the reserve clandestinely. Each year, significant efforts are undertaken to fight fires and create wide firebreaks, but these are currently insufficient to protect the vast reserve and its vital pastures (Figure 7).

Fig. 7. *Bushfire control, Ouadi Rimé-Ouadi Achim Game Reserve, Chad, 13 November 2021 (© John Newby / Sahara Conservation Fund)*

Apart from oryx and addax, the programme in Chad is also being developed to contribute to the recovery of the Critically Endangered dama gazelle. With some 40-50 damas present in the reserve, they represent around half of the world's remaining wild population. Although well protected, the gazelles do not seem to be gaining in numbers. To complement in situ conservation efforts, an embryonic captive-breeding programme is underway. Current holdings include one wild caught adult male and two wild caught females (Figure 8). Since 2020, these have given birth to four offspring, making a total of seven. To build capacity for breeding, while taking great care to manage the unique genetics the local damas share, a group of five animals known from both management histories and genotypes to be descended from Chadian founders will be brought back to Chad from Abu Dhabi in 2022. In the meantime, discussions facilitated by the Antelope Specialist Group are underway to define an optimal breeding strategy.

Fig. 8. *Captive dama gazelles, Ouadi Rimé-Ouadi Achim Game Reserve, Chad, 30 October 2021 (© John Newby / Sahara Conservation Fund)*

There can be little doubt the population of dorcas gazelles in the Ouadi Rimé-Ouadi Achim reserve is the largest remaining in the wild. Conservative estimates would put the population size at at least 50,000 animals. Preliminary results from the recent aerial census on the widely scattered dorcas gazelles seen suggest a density of 6/km^2 over the 2800km^2 core zone around the oryx release site. This closely matches typical results of extensive line transect surveys carried out in the reserve since 2011 (Wacher, Amin et al. in press) and confirms a very healthy population.

The reintroduction programme continues to provide Chadian staff and local partner organizations numerous opportunities to develop skills to manage the reserve and its wildlife. During her recent visit to Chad as part of the EAD team accompanying the addax, veterinarian, Marie-Elena Pesci, was able to take advantage of the unexpected death of a prime male oryx to carry out a mini post-mortem workshop, demonstrating methods to collect samples from freshly dead wildlife (Figure 9). It turned out the oryx had died from peritonitis following a deep wound received during combat with another male oryx. Combat between male scimitar-horned oryx is frequent and can be ferocious; this is the third mortality of this type the project has recorded.

Fig. 9. *Post-mortem on a dead oryx, Ouadi Rimé-Ouadi Achim Game Reserve, Chad, 16 November 2021 (© John Newby / Sahara Conservation Fund)*

In other related news, nine North African ostriches, five males and four females, were released into the reserve in June 2021. All birds were fitted with small, solar-powered satellite transmitters to monitor their movements. The ostriches are part of a programme carried out in cooperation with African Parks Network to assist reintroduction of the species into both the Ouadi Rimé-Ouadi Achim reserve and the Ennedi Natural & Cultural Reserve in northeast Chad. The birds, collected as young chicks from Zakouma National Park, are transported north where they are reared in captivity for up to 18 months before being released. Currently, 12 other ostriches from the 2020-2021 breeding season are awaiting release into the Ouadi Rimé reserve. The feeding behaviour of the released ostriches is being monitored by two Chadian students (Figure 10). Unfortunately, one ostrich that left the confines of the reserve was recently found dead, apparently from dagger or spear wounds. An enquiry is underway.

Fig. 10. *Chadian students monitoring feeding behaviour of reintroduced North African ostriches, Ouadi Rimé-Ouadi Achim Game Reserve, Chad, 31 October 2021 (© John Newby/Sahara Conservation Fund)*

While the translocations and oryx collaring work was going on, project hosted a team of two from French television making a documentary on the reintroduction initiative. If all goes well, the documentary will be aired in February 2022 on the France 5 TV channel.

Ultimately, the long-term success of the antelope conservation work underway will depend on there being safe and suitable habitat for them to inhabit and grow into. With support from the European Union (ECOFAC VI programme) and the World Bank (Albiä Project), funding has been made available to improve the management and governance of the vast and increasingly unique Ouadi Rimé-Ouadi Achim Game Reserve. To ensure that both conservation and human development goals can be met, work is underway to develop a management plan for the reserve, including a redefinition of its boundaries and a zoning plan. It is hoped that this latter will lead to the establishment of core protected area surrounded by a large multiple use zone, with a number of specially protected sites set up for habitat restoration, green belts against desert encroachment, and biodiversity corridors.

In closing, we all would like to extend our sincerest thanks to Justin Chuven, who is leaving the Environment Agency Abu Dhabi after an 8-year spell working on some of the agency's most successful wildlife breeding and restoration programmes. The value of Justin's support to the programme in Chad cannot be underestimated and it's fair to say we wouldn't be where we are today without his constant engagement and his ability to get things done. He will be sorely missed, and we wish him all the very best in his new role with the US Fish & Wildlife Service in Colorado.

References

Wacher, T., Amin, R., Newby, J., Abeye, K., Hatcha, M., Ali, H., Bourtchiakbé, S. Z., & Banlongar, F.N. 2022. *In press.* Gazelle and livestock interactions and impact of water development in a key Sahelian wildlife stronghold: Ouadi Rimé-Ouadi Achim Game Reserve 2011-2019, Chad. *Oryx*.

For more news on these initiatives, please check out SCF's social media feeds on Facebook, Twitter, YouTube and Instagram. For any queries, please contact us at scf@saharaconservation.org

Endangered korrigum (*Damaliscus lunatus korrigum*) and ongoing research in the W-Arly-Pendjari Complex, West Africa

Zuzana Holubová[1], Thomas Rabeil[2], Jared Stabach[3], Aurlus Ouindeyama[4], Jean Didier Akpona[4], Julien Chevillot[5] & Karolína Brandlová[1]

[1] Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague; [2] Wild Africa Conservation; [3] Smithsonian Conservation Biology Institute, Virginia, USA; [4] African Parks, Pendjari National Park, Benin; [5] African Parks, W National Park, Benin

Fig. 1. *Close look at a korrigum in W-Arly-Pendjari Complex (©African Parks / Zuzana Holubová)*

Introduction

Korrigum, *Damaliscus lunatus korrigum* (Ogilby 1837) (Figure 1), one of the six traditionally recognized subspecies of *D. lunatus*, used to be among the most abundant antelopes in sub-Saharan Africa until the early 20th century (Sayer 1982). However, of all the subspecies, it is also the fastest disappearing (Duncan 2013). The species is considered an exclusive grazer (Djagoun *et al.* 2020), inhabiting open plains and performing seasonal migrations towards available floodplains (Child *et al.* 1972). Since 2017, the IUCN Red List has classified korrigum as "Endangered", and according to Chardonnet (2004), its last remaining resident populations occurred only in the W-Arly-Pendjari Complex (Burkina Faso, Niger, Benin) and Waza, Bénoué, Boubandjida national parks and surrounding hunting concessions (Cameroon). Except for the protected areas in Benin, most of these areas face a lack of protection due to insecurity, poverty, and lack of resources. Thus, the future of korrigum populations is very uncertain. Regular monitoring, status update, better knowledge, and immediate actions are required.

Main threats

The most prominent current threats to wildlife in Sub-Saharan Africa are increased agricultural activity, uncontrolled pastoralism, illegal hunting, uncontrolled/late bushfires, pollution of surface water, and climate change (Wittig *et al.* 2007). For korrigum, the main factors of its decline are poaching (Kidjo and Heymans 1991, Scholte 2014), lack of open plains and competition with cattle (Kidjo 1994), predation (Bouché *et al.* 2015), scarcity of fresh grasses during the late dry season, and competition with sympatric grazers (Djagoun *et al.* 2014), and fire management (Dunham *et al.* 2003, Djagoun *et al.* 2014).

Recent surveys in the W-Arly-Pendjari Complex

At the beginning of the 21st century, Sinsin *et al.* conducted several surveys in Pendjari Biosphere Reserve using ground-based line transects (Sinsin *et al.* 2002) and aerial censuses (Sinsin *et al.* 2006, 2008). Not a single korrigum was observed during any of these surveys. Several aerial surveys that targeted wildlife in the WAP Complex were conducted by Bouché *et al.* (2004, 2012, 2015) and Antoninova *et al.* (2019). The total census in 2003 registered 21 observations of 132 individuals of korrigum (Bouché *et al.* 2004). The total census conducted by Antoninova *et al.* (2019) showed slightly better results: 29 observations of 275 individuals remaining in the WAP Complex (excluding most of the protected zones in Burkina Faso: Arly, and W national parks and all hunting zones). Antoninova *et al.* (2019), however, concluded that despite its classification "Endangered" by IUCN, it should be instead considered as "Critically Endangered". This may be the only remaining population and the last potential source for reintroducing the subspecies across West Africa.

Action taken

Due to its low numbers, shyness, and good camouflage (especially during dry season), neither aerial monitoring nor traditional terrestrial survey methods are effective enough to collect the information needed on distribution, current habitat preferences, and movements. Therefore, in December 2020, six korrigum were fitted with GPS/Satellite collars in Pendjari National Park (Figures 2 and 3) as part of the conservation initiatives of the NGO African Parks that manages the park, and PhD research conducted by Z. Holubová from the Czech University of Life Sciences Prague.

Fig. 2. *Blood sampling from after collaring (©Zuzana Holubová)*

Fig. 3. *Herd of 8 korrigum approached by a helicopter (©Marc Guedezounme)*

The collaring team captured three females and three males, each from a different herd, and all in healthy condition. Since fitting the collar, animal GPS positions have been recorded every twelve hours (2 fixes/day). After three months, the recording of fixes was increased to every two hours (12 fixes/day) with the expectation of two years of data collection. Five collars are still active. One collar has had difficulties with signal transmission since August 2021. During animal capture and device fitting, biological samples were collected for further analyses, especially to evaluate population genetics. Given earlier discoveries associated with interspecific hybridization in the Alcelaphini tribe (Robinson *et al.* 1991, Grobler *et al.* 2011),

questions exist about his phenomenon in korrigum and western hartebeest, that often occur in mixed herds (authors assumption).
As part of the research and interest in collecting further information on occupancy, habitat use, social behavior and activity, 56 camera traps were deployed with spacing of 2.5 km in a zone of the most frequent korrigum occurrence (according to previous surveys). The cameras lasted for a 3-month period between March and June 2020 (dry season). Some camera traps have already highlighted the presence of korrigum in the area (Figure 4).

Fig. 4. *Korrigum captured by one of the camera traps deployed in Pendjari NP (©African Parks / Zuzana Holubová)*

New findings
Data collection and analysis are still ongoing. However, preliminary tracking data highlight than none of the tracked animals has explored areas outside the Pendjari NP boundary to date (Figure 5). Neither up north to the Arly NP in Burkina Faso, separated by the Pendjari River, nor to the east where the W National Park is located. Given the migratory ecology of korrigum, questions exist about the impacts of limitations on space use.

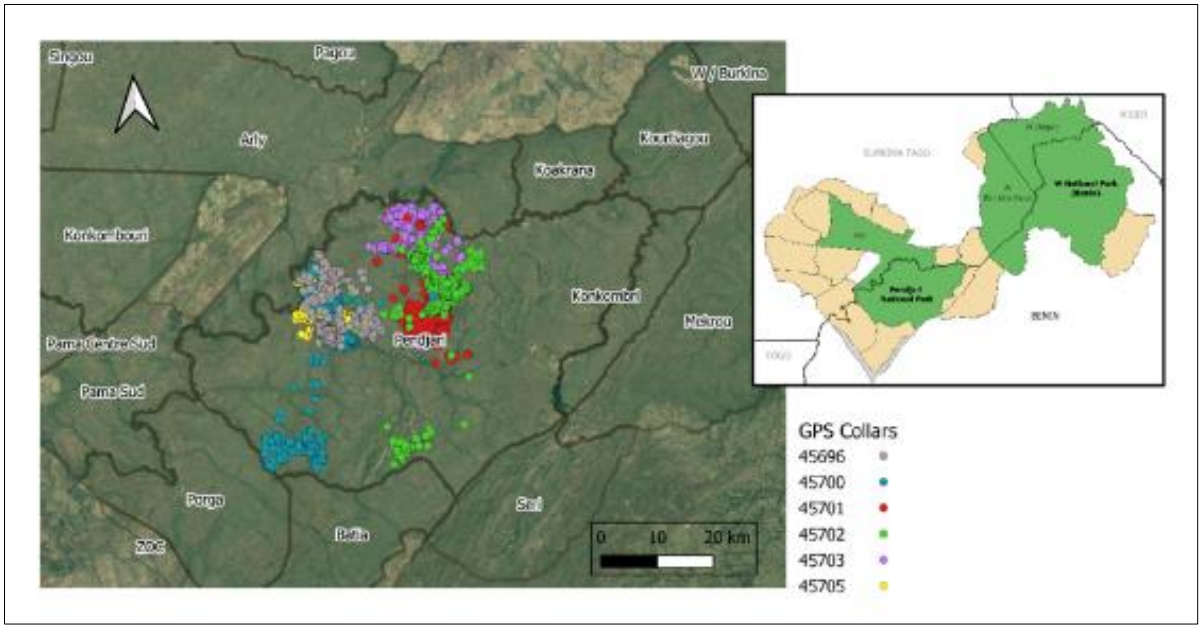


Fig. 5. *Point locations collected by the GPS devices fitted on korrigum (n=6) across the Pendjari National Park in the period from December 2020 to November 2021 (**M**: 45696, 45701, 45705; **F**: 45700, 45702, 45703)*

References

Antoninova, M., Gaylard, A., Gibbons, G., Moueix, Ch., Chevillot, J. & Froment, J.M. 2019: Aerial Survey of W-Arly-Pendjari Complex, Benin - Burkina Faso - Niger, 2019, African Parks, 64 pp.

Bouché, P., Lungren, C., Hien, B. & Omondi, P. 2004. Recensement aérien total de l'Ecosystème 'W'-Arli-Pendjari-Oti-Mandouri-Keran (WAPOK): Avril-Mai 2003. For IUCN.

Bouché, P., Aboudou, M., Amadou, S. A., Amahowe, O. I., Djibey, M., Halilou-Malam-Garba, H. & Mamane, A. 2012. Inventaire aérien de l'écosysteme W-Arly-Pendjari, Mai-Juin 2012. Ouagadougou, Burkina Faso: CITES-MIKE, WAP/UNOPS, Benin, Burkina Faso, Niger.

Bouché, P., Frederick, H. & Kohi, E. 2015. Inventaire aérien de l'écosystème W-Arly-Pendjari, Juin.

Chardonnet, B. & Chardonnet, P. 2004. Antelope Survey Update. Number 9: November 2004. *IUCN/SSC Antelope Specialist Group Report*.

Child, G., Robbel, H. & Hepburn, C. P. 1972. Observations on the biology of tsessebe, *Damaliscus lunatus lunatus*, in northern Botswana. *Mammalia* 36: 342-388.

Djagoun, C. A., Kassa, B., Djossa, B. A., Coulson, T., Mensah, G. A. & Sinsin, B. 2014. Hunting affects dry season habitat selection by several bovid species in northern Benin. *Wildlife Biology* 20: 83-90.

Djagoun, C. A., Sinsin, B. & Wrage-Mönnig, N. 2020. Stable isotope niche segregation between rare topi antelope (*Damaliscus lunatus korrigum*) and other sympatric bulk grazers in Pendjari Biosphere Reserve (Benin): Implication for topi conservation. *Global Ecology and Conservation* 22: e00918.

Duncan, P. 2013. *Damaliscus lunatus* Topi/Tsessebe/Tiang/Korrigum. In: J. Kingdon and M. Hoffmann (eds), *Mammals of Africa*. VI. Pigs, Hippopotamuses, Chevrotain, Giraffes, Deer, and Bovids, 502-510. Bloomsbury Publishing, London, UK.

Dunham, K. M., Robertson, E. F. & Swanepoel, C. M. 2003. Population decline of tsessebe antelope (*Damaliscus lunatus lunatus*) on a mixed cattle and wildlife ranch in Zimbabwe. *Biological Conservation* 113: 111-124.

Grobler, J. P., Rushworth, I., Brink, J. S., Bloomer, P., Kotze, A., Reilly, B. & Vrahimis, S. 2011. Management of hybridization in an endemic species: decision making in the face of imperfect information in the case of the black wildebeest *Connochaetes gnou*. *European Journal of Wildlife Research* 57: 997-1006.

IUCN SSC Antelope Specialist Group. 2017. *Damaliscus lunatus* ssp. *korrigum*. *The IUCN Red List of Threatened Species* 2017: e.T6238A50185772. https://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T6238A50185772.en Accessed on 10 December 2021.

Kidjo, F. & Heymans, J. 1991. Données préliminaires sur la biologie et l'écologie du damalisque (*Damaliscus korrigum* Ogilby) au Parc National de la Pendjari (République du Bénin). *Cahiers d'éthologie* 11(3): 279-288.

Kidjo, F. C. 1994. Contribution à l'étude de la biologie et l´écologie du damalisque (*Damaliscus korrigum*) au Parc National de la Pendjari (Benin). Unpublished master's thesis, Maîtrise en Sciences Naturelles Appliquées et Ecodéveloppement, Benin.

Robinson, T. J., Morris, D. J., & Fairall, N. 1991. Interspecific hybridization in the Bovidae: sterility of *Alcelaphus buselaphus*× *Damaliscus dorcas* F1 progeny. *Biological Conservation* 58: 345-356.

Sayer, J. A. 1982. The pattern of the decline of the korrigum *Damaliscus lunatus* in West Africa. *Biological Conservation* 23: 95-110.

Scholte, P. 2014. Population trends of antelopes in Waza National Park (Cameroon) show escalating effects of poaching and livestock intrusion. *African Journal of Ecology* 52: 370-374.

Sinsin, B., Tehou, A. C., Daouda, I. & Saidou, A. 2002. Abundance and species richness of larger mammals in Pendjari National Park in Benin.

Sinsin, B., Akpona, A. & Ahokope, E. 2006. Dénombrement aérien de la faune dans la Réserve de Biosphère de la Pendjari (Rapport provisoire). GFA, Université d'Abomey-Calavi, Cotonou.

Sinsin, B., Sogbohossou, E. A., Nobime, G. & Adi, M. 2008. Dénombrement aérien de la faune dans la Réserve de Biosphère de la Pendjari. GTZ, Pendjari project.

Wittig, R., König, K., Schmidt, M. & Szarzynski, J. 2007. A study of climate change and anthropogenic impacts in West Africa. *Environmental Science and Pollution Research-International* 14: 182-189.

Fig. 6. *Korrigum and jackal in W-Arly-Pendjari Complex (©African Parks / Zuzana Holubová)*

Hope for Dama Gazelles (*Nanger dama*) in the Aïr Mountains of Niger

Abdoul Razack, Moussa Zabeirou & Cloé Pourchier
Sahara Conservation Fund, Niger
** The authors thank John Newby for review and comments*

Fig. 1. *In the Aïr & Ténéré National Nature Reserve (© SCF / Abdoul Razack Moussa)*

Once widespread in the Sahelian steppes, the dama gazelle (*Nanger dama*) is now, together with the addax (*Addax nasomaculatus*), one of the continent's most threatened antelope, with less than 100 animals surviving in the wild. These remaining individuals are split into four widely scattered and isolated populations in Niger and Chad, with no dispersal between these sites. Poaching, habitat degradation, and periodic drought are the main factors responsible for their decline.

In Niger, the last wild populations of dama gazelle are only found in protected areas, namely the Aïr & Ténéré National Nature Reserve (RNNAT), and the Termit and Tin Toumma National Nature Reserve (RNNTT).

The RNNAT is endowed with an exceptional variety of landscapes (Figure 1), plant species and wild animals, and has been classified as a UNESCO World Heritage Site. However, episodes of rebellion in the region (1992 and 2008) have had a considerable impact on its wildlife and natural resources, and the reserve was placed on the list of World Heritage Sites in Danger in 1992. Since then, regular poaching and deforestation have had a dramatic negative impact on the integrity of the site. In addition, in recent years, traditional gold panning has become one of the greatest threats to wildlife, increasing disturbance, destroying key habitats and polluting the soil.

For several years, no sightings or information on dama gazelles were recorded, suggesting that the RNNAT's population was extinct. In 2014, however, the Sahara Conservation Fund (SCF) and the Nigerien wildlife authorities collected information from local communities about the existence of a small group of dama gazelle living on the Takolokouzet plateau in the centre of the reserve. A mission was organised to verify this information, during which direct and indirect observations of dama gazelles were made, proving their continued presence in the RNNAT (Figures 2 & 3).

Fig. 2. *Dama gazelles in the Aïr mountains, November 2021 (© SCF / Abdoul Razack Moussa)*

This mountainous and steep massif is not the preferred habitat of the dama gazelle but due to its inaccessibility, it has become one of the last refuges for the fauna of the reserve. Over the years, this residual population of gazelles has changed its behaviour and taken up residence in the massif, where there is little or no human disturbance.

As a result of the initial observations and in the interest of the conservation of the species, SCF has been working since 2017 to improve knowledge of the distribution of this small dama population. From January 2017 to March 2020, 12 camera traps were installed on Takoloukouzet, following a standardized protocol based on a 2x2 km grid developed jointly by Wildlife Conservation Society, Conservation International and the Zoological Society of London, and ecological monitoring trips are conducted every six months. Almost the entire presumed distribution area of the dama gazelle in Takoloukouzet has been covered and hundreds of thousands of pictures have been collected, providing substantial information on the species present and the land use in this part of the Aïr Mounatins. During this three-year effort, 17 wild species were photographed on the Takoloukouzet massif (Table 1). Their presence on the massif varies greatly, with the dorcas gazelle (*Gazella dorcas*) being the species most encountered and the most evenly distributed. Dama gazelles are mainly concentrated in the western part of the massif. In comparison with wildlife species, domestic animals are the most abundant.

Fig. 3. *Male dama gazelle in the Aïr mountains, November 2021 (© SCF / Abdoul Razack Moussa)*

Table 1. *17 wild species photographed by camera traps in the Takoloukouzet massif over 3 years 2017-2020*

Latin name	English name
Mammals	
Ammotragus lervia	Barbary sheep
Canis aureus	Golden jackal
Caracal caracal	Caracal
Erythrocebus patas	Common patas monkey
Felis silvestris	Wildcat
Gazella dorcas	Dorcas gazelle
Genetta genetta	Common genet
Hystrix cristata	Crested porcupine
Jaculus jaculus	Lesser Egyptian jerboa
Lepus capensis	Cape hare
Mellivora capensis	Honey badger
Nanger dama	Dama gazelle
Procavia capensis	Rock hyrax
Vulpes rueppellii	Rüppell's fox
Birds	
Cursorius cursor	Cream-colored courser
Oena capensis	Namaqua Dove
Upupa epops	Eurasian hoopoe

The analysis of data also revealed the nocturnal behaviour and activity of dama gazelles, a further indicator of the species' adaptation to the site and threats. Both direct and indirect observations of young dama have recently taken place, showing the dama gazelles continue to breed in the Aïr. During the last field mission in November 2021 several groups of dama gazelles were observed, with, encouragingly, different group structures. In a first group two females and a male were observed, then two females and a youngster, and finally a solitary male, with tracks of a female.

The work done so far allows us to conclude that the dama gazelle population in the Aïr Mountains has been able to adapt to the new context by changing its preferred habitat and lifestyle in order to survive. The latest surveys conducted by SCF, however, also highlight increasing threats from poaching and penetration of the area by motorcycles. There is an urgent need to strengthen surveillance and collaboration with local communities if there is to be any hope of saving this population of dama gazelles.

Fig. 4. *Th team at work in the Aïr mountains, November 2021 (© SCF / Abdoul Razack Moussa)*

Recent sightings of antelopes in Djibouti

Houssein Rayaleh
Association Djibouti Nature, Djibouti, naturedjibouti@gmail.com

Introduction

Djibouti's landmass is 90% desert with an area of 23,200 km^2 and lies on the western side of the Red Sea where it enters the Gulf of Aden (Figure 1). It is situated within the Afar Depression, a branch of the Rift Valley. The landscapes are composed of made of mountains and rocky plateaus, deep dry valleys, and plains, with elevations ranging from 155 m below sea level at Lake Assal, the lowest land point in Africa, to 2021 m at Mousa Ali peak. Despite its extreme semiarid to arid climatic conditions, the country is characterised by a wide variety of terrestrial and marine ecosystems which are home to rare species of fauna and flora which are understudied or not yet studied at all.

Fig 1. *Djibouti (© mapsoftheworkd.com)*

Information on antelopes comes from East (1999), the extensive 1999 Status Assessment Survey on Wildlife in Djibouti (Künzel *et al*. 2000) and Laurent and Laurent (2002), who summarised the status of mammals in Djibouti. There has been no detailed scientific research on Djibouti's antelopes, except for the Beira *Dorcatragus megalotis* (Künzel & Künzel 1999, Heckel *et al*. 2004, Giotto *et al*. 2009, 2013).

Fig. 2. *Soemmerring's Gazelle on the Grand Barra plain (© D. Mallon)*

Current status

Although there have been no targeted surveys, antelopes remain widely distributed in the country and are found in areas close to human settlements like Djibouti city, the capital, and other towns and villages. This 'natural conservation' without human intervention is linked to Djiboutian traditional culture from the nomadic pastoralist lifestyle that does not hunt or trap wildlife for food. Seven species of antelopes currently occur, including some that are endemic to the Horn of Africa. Two more species, Lesser Kudu *Tragelaphus imberbis* and Greater Kudu *Tragelaphus strepciseros*, formerly occurred in the southern half of Djibouti, but there is no information on recent presence.

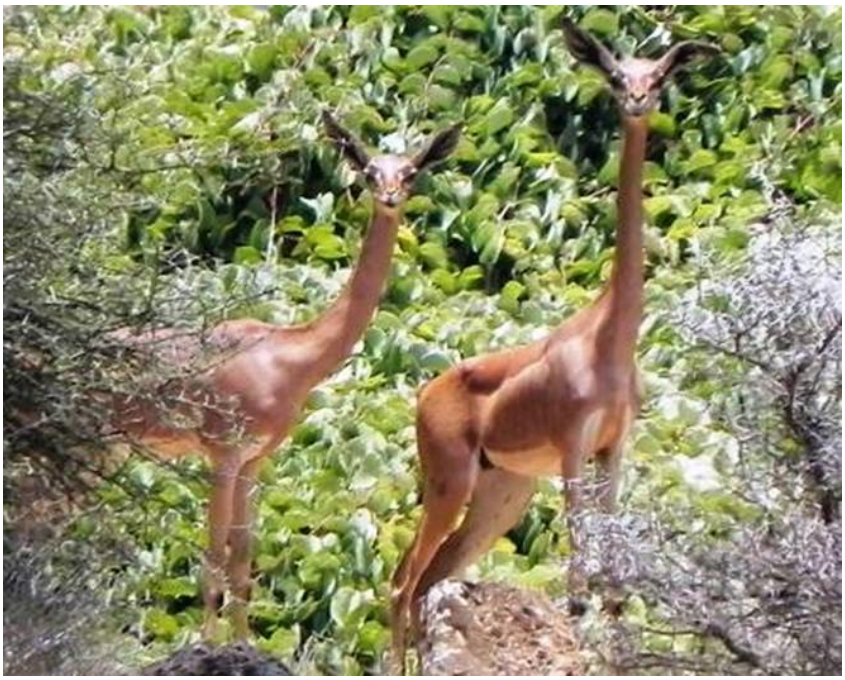


Fig. 3. *Gerenuk (© Houssein Rayaleh)*

Fig. 4. *Salt's Dikdik (© Houssein Rayaleh)*

A brief summary of the current status of antelopes based on Kunzel *et al*. (2000), Laurent and Laurent (2002), and some recent sightings:

Soemmerring's gazelle *Nanger soemmerringii* (Figure 2)
Found throughout light bush, of the country, including plains such as Grand Barra, Petit Barra, Goba'ad, Hanle, Doda, Andaba and the northeastern plains and Goda plateau.

Dorcas gazelle *Gazella Dorcas* (Figure 5)
Widespread throughout, in hills, plains, and bush. Occurs down to 155 m below sea level in the Lac Assal depression.

Gerenuk *Litocranius walleri* (Figure 3)
Occurs locally in small areas in the southern part of the country with *Acacia-Commiphora* bush.

Beisa oryx *Oryx beisa*
Known on the Gammaré Plateau in eastern Djibouti, on the border with Ethiopia.

Klipspringer *Oreotragus oreotragus* (Figure 6)
Occurs in the Goda and Mabla and mountains north of the Gulf of Tadjoura, including in the Forêt du Day protected area,

Beira *Dorcatragus megalotis*
Occurs only in mountains around Assamo in the far south, on the border with Ethiopia and Somalia (Somaliland). This locality is the northwestern edge of its global range.

Salt's dikdik *Madoqua saltiana* (Figure 4)
Widespread in light bush and scrub.

Fig. 5. *Dorcas gazelle (© Houssein Rayaleh)* ***Fig. 6.*** *Klipspringer (© Houssein Rayaleh)*

Recent records

Opportunistic records of antelope species observed or reported by locals were collected during Association Djibouti Nature's field expeditions for scientific research or birdwatching tours from April 2012 to March 2020 (Table 1). Because the data were collected in an irregular way and data collection was rapid and mostly subject to time limitation, I am not in a position to formulate population estimates. However, these findings may suggest that the population of five of the seven antelope species occurring in Djibouti, seem to be decreasing in most areas where observations have been made, despite a lack of baseline information for comparison. I did not observe Beira antelope nor Beisa Oryx, but the local people confirm that these species are still present in their natural habitats, in Ali-Sabieh in the south and in Dikhil in the west, respectively. This brief note may help document current antelope distribution and provide a baseline for more detailed inventory work and help to identify natural areas that have conservation importance in Djibouti which is in the process of rapid development.

References

East, R. 1999. *African antelope database 1998*. IUCN/SSC Antelope Specialist Group, Gland, Switzerland

Giotto, N., Obsieh, D., Joachim, J. & Gerard, J-F. 2009. Population size and distribution of the threatened beira antelope *Dorcatragus megalotis* in Djibouti. *Oryx* 43: 552-555.

Giotto, N., Laurent, A. & Künzel, T. 2013. *Dorcatragus megalotis*. In: J. S. Kingdon and M. Hoffmann (eds). *The Mammals of Africa. VI. Pigs, Hippopotamuses, Chevrotain, Giraffes, Deer, and Bovids*, pp. 315-318. Bloomsbury Publishing, London, UK.

Heckel, J-O., Rayaleh, H.A., Hammer, S., Hammer, C. & Künzel, T. Status of the Beira antelope (*Dorcatragus megalotis*) in the Republic of Djibouti. International Symposium on the Ecology and Conservation of Mini-Antelope Blue Bay Beach Resort, Kiwengwa, Zanzibar 17th – 19.02.2004.

Künzel, T., Rayaleh, H.A. & Künzel, S. 2000. Status Assessment Survey on Wildlife in Djibouti. Final Report. Zoological Society for the Conservation of Species and Populations (Z.S.C.S.P.) and Office National du Tourisme et de l'Artisanat (O.N.T.A.).

Künzel, T. & Künzel, S. 1998. An overlooked population of the beira antelope *Dorcatragus megalotis* in Djibouti. *Oryx* 32:75-80

Laurent, A. & Laurent, D. 2002. *Djibouti: Les mammifères d'hier à aujourd'hui pour demain*. Beira, Toulouse.

Table 1. *Recent sightings of antelopes in Djibouti (V = vehicle; W = walking)*

Date	Group size	Total	Site	Region	GPS	Method
Soemmering's Gazelle *Nanger soemmerringii*						
27/12/2014	4	4	Diksa	Dikhil	11°04'59.13''N 42°10'44.24''E	V
16/01/2015	1-3	11	Petit Bara	Arta	11°21'12.09''N 42°43'16.30''E	V
18/02/2020	1-7	29	Doda/Dorra	Tadjourah	11°08'47.62''N 42°23'26.60''E	V
18/02/2020	3	12	En route to Doda/Dorra	Tadjourah	11°57'53.55''N 42°33'35.29''E	V
Dorcas Gazelle *Gazella dorcas*						
29/12/2013	1-3	5	Damerjog	Arta	11°29'37.28''N 43°11'38.00''E	V
10/01/2014	1-5	13	Kouta Bouya	Diksa/RN6	11°00'24.38''N 42°00'48.24''E	V
10/01/2014	2-3	7	Lake Abbe	Diksa/RN6	11°05'27.16''N 42°53'41.93''E	V
10/01/2014	2	6	Diksa/RN6*	Dikhil	11°00'19.04''N 42°05'50.30''E	V
10/01/2014	1-13	25	Grand Bara	Dikhil	11°09'32.44''N 42°29'00.25''E	V
25/12/2014	3	3	Balambaley	Dikhil	11°07'51.11''N 42°25'18.09''E	V
26/12/2014	1	1	Grand Bara/ RN1	Dikhil	11°11'11.64''N 42°33'33.21''E	V
27/12/2014	3	3	Diksa	Dikhil	11°03'46.65''N 42°11'19.15''E	V
16/01/2015	1-3	9	Grand Bara	Dikhil	11°15'16.65''N 42°40'14.97''E	V
16/01/2015	1	1	Petit Bara	Arta	11°20'58.01''N 42°42'20.46''E	V
11/03/2018	1	5	Goubetto	Ali-Sabieh	11°25'13.46''N 43°02'20.57''E	V
11/03/2018	1-3	13	Gachamaleh/RN5	Ali-Sabieh	11°11'42.13''N 42°56'28.45''E	V
22/12/2018	1-3	6	Oboley/Arrey	Ali-Sabieh	11°07'49.71''N 42°43'48.04''E	V
17/08/2017	1	3	RN9/Qaid	Arta	11°25'31.02''N 42°43'22.20''E	V
17/08/2017	1	1	Karta	Arta	11°25'44.11''N 42°36'38.24''E	V
30/03/2018	1-3	6	Arta Plage	Arta	11°34'40.69''N 42°48'44.74''E	V
15/12/2019	3	3	Douda	Arta	11°35'09.36''N 43°10'47.47''E	V
20/12/2019	3	3	Goubetto	Ali-Sabieh	11°25'13.90''N 43°02'42.73''E	V
20/12/2019	1-3	6	Shebelley	Arta	11°30'25.52''N 43°05'18.07''E	V
13/02/2020	1-3	10	RN9/Sagallou	Tadjoura	11°40'06.44''N 42°43'29.04''E	V
13/02/2020	1-3	31	RN1/PK21	Arta	11°32'56.44''N 42°57'41.30''E	V
13/02/2020	2-5	13	RN9	Arta	11°25'20.09''N 42°44'46.19''E	V
13/02/2020	4	4	RN9	Arta	11°25'23.08''N 42°44'39.52''E	V
13/02/2020	1-5	6	Qaid/RN9	Arta	11°25'26.84''N 42°44'11.24''E	V
13/02/2020	2	6	Karta	Arta	11°26'08.34''N 42°35'58.87''E	V

13/02/2020	1	1	Ghoubet	Tadjoura	11º28’13.57’’N 42º34’11.42’’E	V
13/02/2020	3	12	RN9/Raisa	Tadjoura	11º37’17.17’’N 42º33’06.57’’E	V
18/02/2020	1-9	55	Doda/Dorra	Tadjoura	11º08’47.62’’N 42º23’26.60’’E	V
18/02/2020	2	2	RN 9 near Tadjoura city	Tadjoura	11º46’29.47’’N 42º55’05.77’’E	V
18/02/2020	1-3	7	AsDorra	Tadjoura	11º57’21.41’’N 42º34’20.79’’E	V
18/02/2020	1-5	25	En route to Doda/Dorra	Tadjoura	11º57’53.55’’N 42º33’35.29’’E	V
14/03/2020	1-5	11	RN9	Tadjoura	11º29’07.19’’N 42º33’05.38’’E	V
Gerenuk *Litocranius walleri*						
10/01/2014	1-3	4	Balambaley	Dikhil	11º07’39.87’’N 42º25’09.91’’E	V
10/01/2014	2	4	Diksa/RN6	Dikhil	11º00’19.04’’N 42º05’50.30’’E	V
25/12/2014	1	1	Balambaley	Dikhil	11º07’51.11’’N 42º25’18.09’’E	V
27/12/2014	1-5	10	Diksa	Dikhil	11º03’46.65’’N 42º11’19.15’’E	V
11/03/2018	1-3	5	Assamo	Ali-Sabieh	11º00’12.09’’N 42º48’55.54’’E	V
17/08/2017	1	1	RN9/Qaid	Arta	11º25’31.02’’N 42º43’22.20’’E	V
Klipspringer *Oreotragus oreotragus*						
17/04/2012	1	1	Gerenle	Tadjoura	11º43’32.68’’N 42º36’35.80’’E	V
07/04/2017	1-2	4	Forêt du Day	Tadjoura	11º46’12.20’’N 42º39’07.23’’E	W
22/02/2019	1-3	7	Dittilou	Tadjoura	11º47’13.16’’N 42º41’11.71’’E	W
16/03/2020	1-3	5	Dittilou/Forêt du Day	Tadjoura	11º47’01.11’’N 42º41’14.06’’E	W
Salt’s Dikdik *Madoqua saltiana*						
11/03/2018	2	4	Holl-Holl	Ali-Sabieh	11º20’05.14’’N 42º56’22.02’’E	V
22/12/2018	2	2	Deg weyn	Ali-Sabieh	11º03’39.11’’N 42º46’56.48’’E	V
07/04/2017	2	2	Forêt du Day	Tadjoura	11º46’12.20’’N 42º39’07.23’’E	W
15/12/2019	2	2	Douda	Arta	11º35’09.36’’N 43º10’47.47’’E	V
20/12/2019	2	2	Goubetto	Ali-Sabieh	11º25’13.90’’N 43º02’42.73’’E	V
13/02/2020	2-3	5	RN9	Tadjoura	11º37’37.47’’N 42º33’25.24’’E	V
14/03/2020	2	6	RN9	Tadjoura	11º36’56.89’’N 42º32’59.07’’E	V
17/03/2020	2	4	Dittilou/Forêt du Day	Tadjoura	11º47’01.11’’N 42º41’14.06’’E	W

* Note: RN = *Route Nationale* (National Road)

Recent sightings of antelopes in Kidepo Valley National Park, Uganda

Musiime P. Muramura[1] and Herbert Byaruhanga[2]
[1] m.muramura@gmail.com [2] herbyaruhanga@gmail.com

Fig. 1. *Male White-Eared Kob (© Musiime M. Muramura)*

Fig. 2. *Females White-eared Kob with their youngs (© Musiime M. Muramura)*

Kidepo Valley National Park is one of Uganda's premier protected areas. It covers 1,442 km^2 and lies in north-eastern Uganda, on the borders with South Sudan and Kenya. In January 2021 we travelled to the NP to investigate reports of White-eared Kob (*Kobus kob leucotis*) and Thomson's Gazelle (*Eudorcas thomsonii*), although this area is outside the known distribution of Thomson's Gazelle in southern Kenya and northern Tanzania. We made a 3-day survey inside the park accompanied by seven rangers. We managed to find a male White-eared Kob (Figure 1) and then examined closely some female "Uganda Kob" that were nearby and realised that they were actually female White-eared Kob (Figure 2). In total there were 7 White-eared Kob, 1 male and 6 females.

We then headed over to the Kakine area of the park, which is rather overgrazed, and where the gazelles had been reported. After about one hour of searching, we spotted a pair of gazelles and confirmed that these were actually Mongalla Gazelle (*Eudorcas albonotata*) (Figures 3 & 4). This species is endemic to South Sudan and has never been reported in Uganda before now (Hashim and Kingdon 2013), so these photos provide the first evidence of the species in Uganda. White-eared Kob are reported to occur sporadically or as vagrants in northeast Uganda (East 1999, Fischer 2013).

Fig. 3 & 4. *Mongalla Gazelles (© Musiime M. Muramura)*

We are now planning to take a trip to Matheniko Bokora wildlife reserves in search of Bright's Gazelle (*Nanger granti notata*) which was thought to be extinct in Uganda and was rediscovered in that area about 3 years ago. A group of 36 animals were sighted during an aerial survey, but on the ground we were told they move with herds of over 30 with ostriches for safety, and the current estimate for the reserve is 400!

References

East, R. (compiler). 1999. African Antelope Database 1998. IUCN/SSC Antelope Specialist Group, Gland, Switzerland and Cambridge, UK.

Fischer, F. 2013. *Kobus kob* Kob. In: J. S. Kingdon and M. Hoffmann (eds), *The Mammals of Africa, VI. Pigs, Hippopotamuses, Chevrotain, Giraffes, Deer, and Bovids*, pp. 439-444. Bloomsbury Publishing, London, UK.

Hashim, I. M. & Kingdon, J. 2013. *Eudorcas albonotata* Mongalla Gazelle. In: J. Kingdon & M. Hoffman (eds), *Mammals of Africa. VI. Pigs, Hippopotamuses, Chevrotain, Giraffes, Deer, and Bovids*, pp. 369-372. Bloomsbury Publishing, London, UK.

Celebrating 50th anniversary of the "Operación Mohor": avoiding the complete extinction of the mhorr gazelle (*Nanger dama mhorr*)

Teresa Abáigar
Estación Experimental de Zonas Áridas-CSIC, Crta de Sacramento sn, 04120-La Cañada de S, Urbano, Almería, Spain, abaigar@eeza.csic.es

Dedicated to the pioneers of the mhorr gazelle conservation program: Jose Antonio Valverde, Antonio Cano and Mar Cano

Origin

Very often, at the origin of the important events, people of special charisma, certain circumstances and, of course, a "little bit of luck" come together. This is the case of the so-called "Operación Mohor" (in Spanish), for which, this year 2021, we celebrate the 50th anniversary.

On the night of 14th January 1971, a group of seven mhorr gazelles (one male and six females) (*Nanger dama mhorr*) along with 17 dorcas gazelles (*Gazella dorcas neglecta*), from the Western Sahara (ex-Spanish colony) arrived at "La Hoya" farm (Figure 1), a property of the Estación Experimental de Zonas Áridas (EEZA), a research center of the National Spanish Research Council (CSIC), in Almería, southeast Spain. This was the starting point for the creation of the Saharan Fauna Park Rescue (in Spanish: Parque de Rescate de la Fauna Sahariana; PRFS), and the beginning of a captive breeding program that saved the mhorr gazelle from almost certain extinction. Later the same year, two more mhorr females joined the original group. Finally, on 14th November 1975, the last group of 10 mhorr gazelles (four males, six females) that had been kept in the military HQ in the Western Sahara, arrived at the PRFS. Joining the mhorr gazelles were more dorcas gazelles, Cuvier´s gazelle (*Gazella cuvieri*), Saharan Barbary sheep (*Ammotragus lervia sahariensis*) and other Saharan animal species which arrived and settled at the PRFS. For more detail see Valverde´s memoirs (Valverde 2004).

The people who promoted and piloted this project in the early years were Professor José Antonio Valverde, probably one of the best Spanish ecologists, mainly recognized for his role in the creation of the Doñana National Park and the Biological Station of the same name (EBD-CSIC), and Antonio Cano, curator of the museum at the EEZA. Antonio Cano was a lawyer by training but with a naturalist's heart, great skills and abilities in photography and communication and, above all, a restless person and faithful friend. When Professor Valverde suggested that he embark on the risky adventure of saving the mohor antelope, he did not hesitate.

The fortunate circumstances that accompanied this adventure were, on the one hand, the contacts and friendships that Professor Valverde had with the Spanish military in the area who were keeping some specimens of mhorr in captivity; on the other, the existence of a suitable space in "La Hoya" farm, as well as a suitable climate for the gazelles' adaptation. No other site in Europe could be more suitable. Another fortunate circumstance was that a daughter of Antonio Cano, Mar Cano, - at that time a biology student - immediately joined the project. Mar's dedication of a lifetime to the conservation of this species is well known.

Fig.1. *"La Hoya" farm (© T. Abaigar CSIC)*

First steps

The challenges taken on by these pioneers were enormous. Few people would have accepted the risk of the preservation of such an important species, one the verge of extinction, without a lack of knowledge of its most basic aspects of its biology and behavior. The first challenges came soon after, with the need to solve such basic aspects necessary to their survival as: what is the most appropriate food? how much space do they need to live in captivity? what is their gestation period? how to capture them if necessary? how many males and females to put in the same enclosure? what are their main diseases? etc. In the absence of other experience, some of these questions were resolved by comparison with domestic species (goats) and sometimes by trial-and-error. It was especially important to implement a capture system of frequent and safe use. Since these early years, the PRFS has continued using a capture system that utilizes nets for manual immobilization of gazelles. Also, the diet of gazelles, the design of enclosures and herding of gazelles, have undergone a few modifications since these early beginnings. These first years were exciting because they were so full of new knowledge of the mhorr gazelles, but some mortality also occurred during the first years. The story of the challenges that were faced in these early years can be read in Cano (1988, 1991) and De Boroviczény (1988).

But it was not only about ensuring the survival and reproduction of the mhorr gazelles. The real engagement was to establish a long-term and science-based *ex situ* conservation program for this species. In this sense, we must also recognize the success and the correct decisions of Antonio and Mar Cano in the data collection and meticulous recording of genetic and demographic information that constitutes the basis of management of any *ex-situ* conservation program. It should be noted that in the early 1970s, it was very far from that. Later the global

zoological community would establish standards of species management (EEP/ EAZA and SSP/AZA programs). When this happened, the mhorr EEP program – as well as its International Studbook - was one of the first to be approved (1986). At the beginning of the 1980s, once the first difficulties had been overcome and when the population began to grow, contacts began with national and international zoos in order to establish breeding groups in other centers, thereby assuring the survival of the species in case of a catastrophe, and providing more resources for the global *ex-situ* conservation program. The first groups of mhorr gazelle were moved to several zoos in Germany (Osnabrück, Berlin East, Munich) and to San Diego Zoo in the US in 1981 (Dolan 1981).

And from the very beginning, reintroduction of the mhorr gazelle into native areas in North Africa was a priority of the *ex situ* conservation program. The first reintroduction project of the mhorr was carried out in Senegal in 1984 (Cano et al. 1993), just 13 years after the first arrival of gazelles in Almeria.

Achievements

After 50 years, I am quite confident that the complete extinction of the mhorr gazelle has been averted. The species has fully adapted to live under the management conditions imposed by captivity, and natural reproduction is successful (Figure 2). Currently the population is around 350-400 individuals distributed in different zoological institutions in Europe, North America, and the Middle East. All these captive populations are registered in the international studbook and managed according to the standards of the European Association of Zoo and Aquaria (EAZA) and the Association of Zoos & Aquariums (AZA).

During the 50 years since the mhorr gazelle was brought into captivity, different national and international research groups have collaborated on research into the necessary knowledge on the biology, physiology and behavior. The acquired knowledge has been essential to ensure their survival and well-being in captivity. We cannot make an inventory of all the publications during the last decades, but I would like to highlight some of them on those subjects which are relevant and also common to other threatened species under similar conservation programs, such as the effects of the loss of genetic variability, the basis of their physiology of reproduction as well as implementing assisted-reproductive technologies and, the studies of their behavior as a basis for improving the well-being of individuals in captivity.

While 19 mhorr gazelles (5.14) were moved from the Western Sahara to the PRFS in Almeria, only 11 of them (2.9) left descendants (Ruiz-López et al. 2009) and Moreno et al. (2011) pointed out the possibility of just genetic five founders (1.4). The number of identified haplotypes into the captive populations was only two, although their nucleotide diversity was higher than for some wild populations of dama gazelle in Niger (Senn et al. 2014). All these studies reveal a scarcity of genetic variability which will inevitably diminish over time. The possibility of finding new founders is null.

The effects of the limited numbers of founders and the inevitable loss of genetic variability on different biological traits and functionalities has been evaluated. It is worth mentioning publications that refer to reproductive fitness (Alados and Escós 1991, Cassinello 2005, Roldán et al. 2006, Ruíz-López et al. 2010, Moreno et al. 2011), survival (Alados and Escós 1991, Cassinello 2005, Ibañez et al. 2013) and body condition (Ibañez et al. 2011). The duration of the ovarian cycles and the length of gestation of females have both hormonal and behavioral characteristics (Pickard et al. 2001, 2003), as well as semen characteristics in males (Holt et al. 1996, Cassinello et al. 1998, Abaigar et al. 1999, Garde et al. 2003, Roldan et al. 2006, Ruiz-

López et al. 2010). Assisted reproductive techniques (ARTs) and artificial insemination with frozen semen has been implemented (Holt et al. 1996, Roldan et al. 2006, Berlinguer et al. 2008). The results derived from studies related to social behavior, relationships between hierarchy and aggression and protocols of enrichments (Cano 1991, Cassinello and Pieters 2000, Rose et al. 2008) have contributed important knowledge to improve the welfare of captive mhorr gazelles.

As mentioned, the reintroduction of the mhorr gazelle into their original areas of distribution in North Africa was always a priority and the final purpose of their *ex-situ* captive conservation program. Until now, the mhorr gazelle has been reintroduced in several protected areas (PA) in Senegal in 1984 (Cano et al. 1993), Morocco in 1992 and Tunisia in 1994 (Abaigar 2018). The evolution, success and current situation of these reintroduced populations are uneven depending on intrinsic and extrinsic factors (Abáigar 2018), the management of each PA being one of the most important.

In 2015, for the first time, a group of 24 mhorr gazelles were released into the wild in southern Morocco (Abáigar et al. 2019). This unique experience has shown basic ecological aspects of the species in the wild such as the size of its areas of use, the selection of habitats and their characteristics, and the rhythms of activity (Abáigar et al. 2019, 2020), all of them essential for the success of future reintroductions.

Finally, it should be noted that the experience of these 50 years has made the EEZA a reference center in the management and conservation of endangered North African ungulates and, as such, it is an important center for training for managers and rangers of North African countries.

Fig.2. *Dama Mhorr (© T. Abaigar CSIC)*

Future

In spite of the achievements described above, during 50 years of the mhorr gazelle´s *ex- situ* conservation program, the two main objectives (ensuring survival and reintroduction in the places of origin) are still continuing and research to support the success of these objectives continues as a fundamental pillar of the program.

Increasing the existing captive population is the only way to ensure, not only the survival of the mhorr gazelles but also one of priority actions within the Conservation Strategy (2019-2028) (Al Ain Zoo et al. 2019) for the entire dama gazelle (*Nanger dama*) species. Currently, dama gazelle is one of the most threatened ungulates in Africa and is classified as "Critically Endangered" on the IUCN Red List. Increasing current populations needs more space and economic resources. In that sense, more zoological center participants in the EEP and SSP program are desirable. The captive population in Almeria is the largest (about 150 individuals). Moving the facility to a bigger area is one of the EEZA´s ambitions and priorities. Managing the population as is being done (under the standards of EEP / EAZA and SSP/AZA) is the best way to slow down the inevitable loss of genetic variability and its possible (and deleterious) consequences for long-term survival. After all, conserving a species means conserving the maximum genetic variability possible so that individuals can adapt and evolve successfully in the face of both foreseeable and unforeseeable environmental changes.

Monitoring the effects of inbreeding on natural traits and performance (reproductive success, disease resistance) are research priorities. More studies are also needed to delve deeper into the causes and consequences of stress and how it affects behavior and well-being. Finally, the survival of gazelles after release into the wild will be related to their capacity to recognize predators and threats and to respond appropriately to them. If these capacities are innate or learned and how they have been affected in animals raised for generations in captivity is something that must be investigated to increase the success of reintroductions.

Finally, more and more successful reintroductions remain a pending issue. Despite the degradation and occupation of its original habitat, there are still large areas where the mhorr gazelle could survive in complete freedom. The experiences carried out so far clearly show us which are the factors that condition the success of reintroduction projects, in areas where social and political conflict, as well as the persistence of poaching, limit the success of any conservation project. It is necessary to involve the local population in these projects, from the very beginning, making them feel that these kinds of projects are compatible with their traditional way of life, and that it will bring them benefits in the short, medium, and long term. It is also essential to have enough material, financial and human resources to carry out an exhaustive, long-term (decades) monitoring of these projects. Finally, we should support economic and social projects in range states that contribute to the autonomous economic development of these countries, to the improvement of the well-being of the entire local population and to greater education.

References

Abaigar, T., Cano, M., Espeso, G. and Ortíz, J. 1997. Introduction of mhorr gazelle (*Gazella dama mhorr*) in Bou-Hedma National Park, Tunisia. *International Zoo Yearbook* 35:311-316.

Abaigar, T., Holt, W.V., Harrison, R.A.P. and Del Barrio, G. 1999. Sperm subpopulations in boar (*Sus scrofa*) and gazelle (*Gazella dama mhorr*) semen as revealed by pattern analysis of computer-assisted motility assessments. *Biology of Reproduction* 60:32-41.

Abáigar, T. 2018. Status of Reintroduction. In: *The dama gazelles: last members of a critically endangered species.* (E.C. Mugall, ed.)

Abáigar, T., Rodríguez-Caballero, E., martinez, C., Amaouch, Z., Samlali, M.L., Aparicio, F., El Balla, T., Essalhi, A, Fernández, J., García, F., Haya, M., M´Barek, A, M´Barek H., González, L.M. and Fernández de Larrínoa, P. 2019. The first reintroduction Project for mhorr gazelle (*Nanger dama mhorr*) into the wild: knowledge and experience gained to Support future conservation actions. *Global Ecology and Conservation* 19: e00680.

Abáigar, T., Martínez, C., Amaouch, Z., Alifal, M., Lemdimigh, A., El Makki, S'A., El Mokhtar, M., Samlali, M.L., Fernández de Larrínoa, P. and Rodriguez-Caballero, E. 2020. Habitat requirements of the Mhorr gazelle: what does this species need to survive in the wild? *Global Ecology and Conservation* 24, e01389.

Al Ain Zoo, IUCN SSC Antelope Specialist Group and Royal Zoological Society Scotland (RZSS). 2019. *Dama gazelle (Nanger dama) conservation strategy 2019-2028*. Al Ain Zoo, Abu Dhabi, United Arab Emirates.

Alados, C.L and Escós, J. 1991. Phenotypic and genetic characteristics affecting lifetime reproductive success in female Cuvier´s, Dama and Dorcas gazelles. *J. Zool. Lond.* 223:307-321.

Berlinguer, F., González, R., Succu, S., del Olmo, A., Garde, J.J., Espeso, G., Gomendio, M., S. Ledda, S. and Roldan, E.R.S. 2008.In vitro oocyte maturation, fertilization and culture after ovum pick-up in an endangered gazelle (*Gazella dama mhorr*). *Theriogenology* 69 (2008) 349–359.

Cano, M. 1988. Sobre las poblaciones de ungulados del Parque de Rescate de la Fauna Sahariana durante el periodo 1971-1988. *Boletín del Instituto de Estudios Almeriense, número extra Homenaje a Antonio Cano Gea*: 281-292. Almería (Spain).

Cano, M. 1991. El antílope mohor (*Gazella* (*Nanger*) *dama mhorr* Bennett 1832). Dissertation, Universidad de Granada, Spain.

Cano, M., Abaigar, T and Vericad, J.R. 1993. Establishment of a group of dama gazelles (*Gazella* (=*Nanger*) *dama*) for reintroduction in Senegal. *International Zoo Yearbook* 32:98-107.

Cassinello J, Abaigar T, Gomendio M, Roldan ERS. 1998. Characteristics of the semen of three endangered species of gazelles (*Gazella dama mhorr*, *G. dorcas neglecta* and *G. cuvieri*). *J Reprod Fertil* 113:35–45.

Cassinello, J. 2005. Inbreeding depression on reproductive performance ans survival in captive gazelles of great conservation value. *Biological Conservation* 112 (3): 453-464.

Cassinello, J. and Pieters, I. 2000. Multi-male captive groups of endangered dama gazelle: social rank, aggression and enclosure effects. *Zoo Biology* 10(2): 121-129.

De Boroviczény, Imre. 1988. El rescate de las gacelas mohor. *Boletin del Instituto de Estudios Almeriense, número extra Homenaje a Antonio Cano Gea*: 43-50. Almería (Spain).

Dolan, J.M. 1981. The Mhorr gazelle (Gazella dama mhorr) (Bennett, 1833): a case for captive propagation. *The Journal of Zoo Animal Medicine* 12(4):114-117.

Garde, J.J., Soler, A.J., Cassinello, J., Crespo, C., Malo, A.F., Espeso, G., Gomendio, M. and Roldan, E.R.S. 2003. Sperm cryopreservation in three species of endangered gazelles (*Gazella cuvieri*, *G. dama mhorr*, and *G. dorcas neglecta*). *Biology of Reproduction* 69, 602–611.

Holt, W.V., Abaigar, T. and Jabbour, H.N. 1996. Oestrus synchronization, semen preservation and artificial insemination in the Mohor gazelle (*Gazella dama mhorr*) for the establishment of a genome resource bank programme. *Reproduction, Fertility and Development* 8(8):1215-1222.

Ibáñez, B., Moreno, E. and Barbosa, A. 2011. No inbreeding effects on body size in two captive endangered gazelles. *Mammalian Biology* 76 (2011) 748–754.

Ibañez, B., Moreno, E. and Barbosa, A. 2012. Parity, but not inbreeding, affects juvenile mortality in two captive endangered gazelles. *Animal Conservation* 16 (1): 108-117.

Moreno, E., Ibáñez, M.B. and Barbosa, A. 2011. Mother traits and offspring sex in two threatened gazelle species in captivity. *Journal for Nature Conservation* 19 (2011) 148–153.

Pickard, A.R., Abáigar, T., Green, D.I., Holt, W.V. and Cano, M. 2001. Hormonal characterization of the reproductive cycle and pregnancy in the females Mohor gazelle (*Gazella dama mhorr*). *Reproduction* 122 (4): 571-580.

Pickard, A., Holt, W.V., Green, D.I., Cano, M. and Abaigar, T. 2003. Endocrine correlates of sexual behavior in the Mohor gazelle (*Gazella dama mhorr*). *Hormones and Behaviour* 44 (4):303-310.

Roldan, E.R.S., Gomendio, M., Garde, J.J., Espeso, G., Ledda, S., Berlinguer, F., del Olmo, A., Soler, A.J., Arregui, L., Crespo, C. and González, R. 2006. Inbreeding and Reproduction in Endangered Ungulates: Preservation of Genetic Variation through the Organization of Genetic Resource Banks. *Reprod. Dom. Anim.* 41 (Suppl. 2): 82–92.

Rose, P., Roffe, S. and Jermy, M. 2008. Enrichment methods used for *Giraffa camelopardalis* and *Gazella dama mhorr* at The East Midland Zoological Society: Twycross Zoo. *RATEL*, 35 (1): 19-24.

Ruiz-Lopez, M.J., Roldán, E.R.S., Espeso, G. and Gomendio, M. 2009. Pedigrees and microsatellites among endangered ungulates: what do they tell us? *Molecular Ecology* (2009) 18, 1352–1364.

Ruíz-López, M.J., Evenson, D.P., Espeso, G., Gomendio, M. and Roldán, E.R.S. 2010. High levels of DNA fragmentation in spermatozoa are associated with inbreeding and poor sperm quality in endangered ungulates. *Biology of Reproduction* 83 (3):332-338.

Senn, H. Banfield, L., Wacher, T., Newby, J., Rabeil, T., Kaden, J., Kitchener, A.C., Abaigar, T., Silva, T.L., Maunder, M. and Ogden, R. 2014. Splitting or Lumping? A Conservation Dilemma Exemplified by the Critically Endangered Dama Gazelle (*Nanger dama*). *PLoS ONE* 9(6) e98693.

Valverde, J.A. 2004. *Sáhara, Guinea, Marruecos, Expediciones africanas. Memorias de un Biológo Heterodoxo*. Quercus V&V, 272 pp. Madrid (Spain).

Antelope News

West Africa

Albino duiker in Ghana

A camera trap project in Mole NP, Ghana, photographed an extremely rare image of an albino red-flanked duiker (*Cephalophus rufilatus*), posted on Facebook by the Australian High Commission in Accra. The camera traps were provided by Australian Aid.

Source and image:
https://m.facebook.com/AustralianHighCommissionGhana/photos/a.948501571873601/4398150143575376/?type=3

Termit Tin Toumma National Nature Reserve, Niger

Termit Tin Toumma NNR, Niger, harbours one the four remaining populations of dama gazelle *Nanger dama* and other threatened Saharan species. A new reserve base is under construction and a ceremony took place in late November 2020 to lay the first stone. A water tower, pump, and solar panels have also been installed. The Ministère de l'Environnement, de la Salubrité Urbaine et du Développement Durable has officially announced that it has made available to the reserve 43 staff from the Bureau des Eaux et Forêts (Bureau of Water and Forests). The new reserve Director, Fred Dumont, took up his role from 12 November, and a new head of anti-poaching has been appointed. A total of 150 person/days of patrols have been conducted, in

collaboration with the Regional Directorate for the Environment of Zinder and the Departmental Directorates of Tesker and Tânout. Two dorcas gazelles confiscated from poachers were released into the reserve. Firebreaks to control bush fires are being established.
Source: Lettre d'information de Parcs de Noé, novembre 2020

West African Sitatunga Group: next workshop in January 2022

The West African Sitatunga Group (WASG) is a network of civil society organizations active in the conservation of Sitatunga (*Tragelaphus spekei*) in West Africa. WASG will organize its fourth members' meeting by January 19 and 20, 2022 in Zinvié, in the heart of Community Natural Park of the Sitatunga Valley, Benin. The meeting will revive the group for a better conservation of the species.
Source: West African Sitatunga Group, Benin

Central Africa

Wild dama gazelle caught in Chad

In December 2020, members of the Oryx Project team spotted three wild dama gazelles – one of the world's most endangered species – visiting the Oryx Base Camp at Ouadi Rime-Ouadi Achim Reserve, almost on a daily basis. In January, two female dama gazelles began to approach the enclosures where the Project's three captive dama – a male, a female, and a young female born on 24 August 2020 – are located. Throughout January and February, the southern movement of nomads through the Reserve intensified and the wild dama eventually left. However, one female soon returned, presumably attracted by the presence of the male in the enclosure. The team constructed an access point in one part of the enclosure, removed an area of fence and placed hay on the ground to further encourage the wild dama gazelle to enter. After several more days, the wild female dama gazelle decided to enter. The team quickly closed off the access point and opened the inner door the day after so that the group of four could interact. After a brief period of nervousness, the new gazelle quickly integrated into the group.
Source: https://saharaconservation.org/incredible-passive-capture-of-a-wild-dama-gazelle/

East Africa

Hirola progress in Ishaqbini, Kenya

From 5 to 9 November 2020, the Ishaqbini Hirola Sanctuary in Garissa County, Kenya, fitted tracking devices on five hirola, in partnership with the Kenya Wildlife Service and the Northern Rangelands Trust to monitor Hirola movement patterns in the sanctuary and the wider Ishaqbini Hirola Community Conservancy, once they are released. The founder population in the Sanctuary numbered 48 but had reached 118-130 animals by December 2019, a 13% annual average growth rate. The sanctuary is now close to carrying capacity and there is a need to release groups of males to boost the population in the wider Ishaqbini Conservancy. The collars will send a GPS position twice a day to the sanctuary management team which will enable the rangers to monitor the animals remotely in preparation for release through a gate system in a large boma that allows the hirola to enter and leave while excluding predators. To prevent outbreaks of disease, veterinary surveillance and management are conducted inside the sanctuary. A community vaccination programme with the Garissa County Veterinary Department, supported by San Diego Zoo Global, aims to vaccinate over 50,000 head of cattle, sheep, and goats against prevalent viruses and bacterial infections.

Source: NRT Quarterly, December 2020

Greater Kudu seen in northern Somalia, Somaliland

On 7 January 2020, ASG member Dr Osman Gedow Amir took photographs of a small number of female greater kudu (*Tragelaphus strepciseros*) in the self-declared Republic of Somaliland, northern Somalia, (Figure 1). The photos were taken at the base of the Goolis range, while travelling to the west of Hargeisa, the capital. Greater Kudu has been recorded in northern Somalia through the first half of the 20th century but this is the first confirmed record of the species there for 20-30 years so it is good news that the species is still present.

Fig. 1. *Female greater kudu in the foothills of the Goolis range (© O.G. Amir)*

Beisa Oryx census, Kenya

The results of an aerial count conducted in Nakuprat Gotu Community Conservancy have revealed a 10% per annum increase in the population of Beisa oryx. However, the count also reported a fivefold increase in livestock numbers since 2018. An estimated 880 Beisa oryx were counted in July 2020, compared to 709 individuals in 2018. Beisa oryx populations are declining across much of Africa. Habitat loss, hunting, and competition with livestock for pasture all threaten the future of this antelope and only an estimated 8,000 - 9,000 individuals remain. Nakuprat-Gotu Community Conservancy is part of a network of community conservancies across Kenya's northern rangelands. The community conservancy model looks at wildlife conservation in the context of wider socio-economic landscape – recognizing that community-led endangered species recovery programmes can only be successful with strong local governance, peace, natural resources management, security, and thriving livelihoods. Nakuprat-Gotu's locally employed ranger team have intensified anti-poaching patrols. The Conservancy has also conducted awareness raising in villages through dialogue and sport and launching school conservation clubs to engage and inspire young people. A new rainwater harvesting earth pan is being constructed in the area, which could lead to increased human and livestock activity in Beisa oryx range. The data from this aerial count, and other data collected by conservancy rangers, the Nakuprat Gotu conservancy management team can work with the National Environmental Management Authority (NEMA) to propose an alternative site for the dam, away from the Beisa oryx home range.

Source: NRT Quarterly, December 2020

Dikdik poaching in Kenya

In June 2021, three men were arrested by officers from the Kenya Wildlife Service (KWS) for poaching 172 dik-diks in Galana conservancy, which borders the Tsavo East National Park. The three suspects were also in possession of 5 motorbikes and 20 torches that were used during the crime. On 8 July 2021, three men were sentenced to jail in Tana River County for poaching

140 dikdik and 3 gerenuk. These incidents follow reports from 2019 of heavy poaching of dikdik in Taita Hills sanctuary, where 59 arrests over 2 years were related to passion of dikdik meat or body parts.
Sources: https://kenyannews.co.ke/news/ https://allafrica.com/stories/202107090050.html https://www.independent.co.uk/voices/campaigns/giantsclub/dikdik-numbers-in-taita-hills-pushed-to-near-extinction-a8920036.html

Asia and the Middle East

A new generation of gazelles in Georgia

Young goitered gazelles (*Gazella subgutturosa*) were photographed on the Samukhi Plain in Vashlovani Protected Area, eastern Georgia, in late 2020. This is the sixth generation of gazelles born at the location since the species was reintroduced to the country in 2014 and is a further indicator of the success of that project. The photographs follow earlier material, including a video released in 2019, documenting a growing population in Vashlovani. The state programme for reintroducing gazelles in Georgia follows the decimation of their population by poaching in the last century and is run by the Ministry of Environmental Protection and Agriculture of Georgia, WWF-Caucasus, the German Federal Ministry for Economic Cooperation and Development, the German state development bank KfW, and the Ministry of Ecology and Natural Resources of Azerbaijan – the reintroduced gazelles were brought from the large population in Shirvan National Park, Azerbaijan. Although a major population of gazelles was found in Georgia in the 19th century, it was extirpated throughout decades of unlimited hunting in the 20th, with last members disappearing in the 1990s. In 2019 the ministry banned bird-hunting on Samukhi Plain, citing changes in gazelle behaviour in reaction to gunfire. Hunters shooting at birds caused startled animals to move from open areas to forested locations, where they became more vulnerable to predation by wolves.
Source: https://agenda.ge/en/news/2020/1911

Arabian oryx increases in Abu Dhabi

The number of Arabian oryx in the UAE's largest nature reserve has increased by more than a fifth in less than four years, according to a new study by the Environment Agency Abu Dhabi (EAD). carried out an aerial survey of the 6,000-square-kilometre Al Dhafra reserve to assess the success of ongoing conservation efforts. The oryx population in the Al Dhafra reserve now stands at 946, a 22% increase on four years ago. Al Dhafra was home to just 160 of the animals in 2007, when the Sheikh Mohamed bin Zayed Arabian Oryx Reintroduction Programme was established. On the survey, more than three quarters of the animals were found to be female, and 83 calves were recorded, accounting for almost 9% of the herd.

The 50 dirham note was issued as a tribute to the oryx.

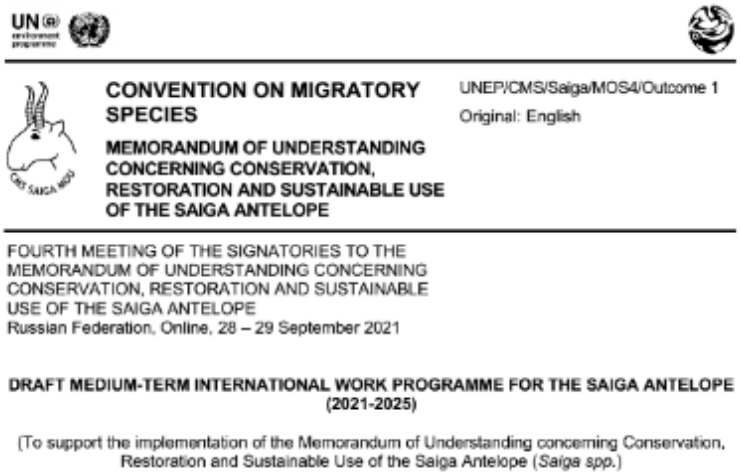
Source: https://www.thenationalnews.com/uae/environment/arabian-oryx-population-surges-at-abu-dhabi-nature-reserve-as-conservation-efforts-pay-off-1.1235813#23

Saiga: Numbers increase again

The annual aerial census of saiga in Kazakhstan did not take place in 2020 due to Covid restrictions. The 2021 census began on 19 April. The total population was estimated at 842,000, more than twice the number in 2019 (Ural population - 545,000, Bet-pak Dala population – 285,000, Ustyurt population -12,000). The census was conducted before the females give birth in early summer, so the number of saiga in Kazakhstan likely already exceeds 1 million. This is hugely encouraging news and marks a major improvement in saiga global status since the mass mortality event in 2015 when disease caused the death of more than 200,000 animals. The rapid increase reflects both the saiga's high fecundity (females can breed in their first year and many bear twins) and the successful implementation of conservation measures in Kazakhstan, including new protected areas, anti-poaching, illegal trade controls, government investment, community and education programmes, and work by national and international NGOs.
Source: https://www.facebook.com/acbk.eng/posts/3995147867243527

Saiga: CMS Memorandum of Understanding

The Convention on Migratory Species *Memorandum of Understanding concerning Conservation, Restoration and Sustainable Use of the Saiga Antelope* took effect in 2006 and has been signed by all five Range States and 9 cooperating organizations, including the IUCN Species Survival Commission. The MOU, together with its associated Medium-Term International Work Programme (MTIWP), provides a road map to guide the implementation of conservation action for the saiga antelope, including sustainable use and trade. The long-term vision of the MTIWP under the MOU is to restore saiga populations to the point that sustainable use can again be envisioned. The Fourth Meeting of Signatories of the MoU was held online from 28-29 September 2021 and hosted by the ministry of the Environment of the Russian Federation. The meeting approved the new MTIWP for 2021-2025 and also endorsed a new report *The Sustainable use of Saiga Antelope: Perspectives and Prospects*.



UNEP/CMS/Saiga/MOS4/Outcome 1
Original: English

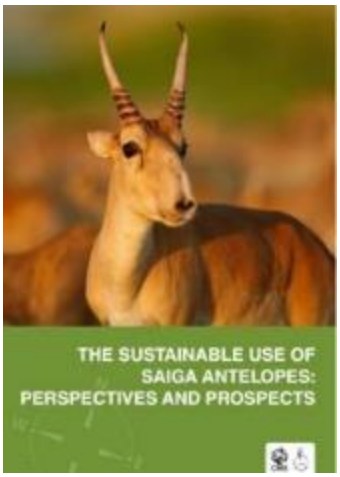
CONVENTION ON MIGRATORY SPECIES

MEMORANDUM OF UNDERSTANDING CONCERNING CONSERVATION, RESTORATION AND SUSTAINABLE USE OF THE SAIGA ANTELOPE

FOURTH MEETING OF THE SIGNATORIES TO THE MEMORANDUM OF UNDERSTANDING CONCERNING CONSERVATION, RESTORATION AND SUSTAINABLE USE OF THE SAIGA ANTELOPE
Russian Federation, Online, 28 – 29 September 2021

DRAFT MEDIUM-TERM INTERNATIONAL WORK PROGRAMME FOR THE SAIGA ANTELOPE (2021-2025)

(To support the implementation of the Memorandum of Understanding concerning Conservation, Restoration and Sustainable Use of the Saiga Antelope (*Saiga spp.*)



Source: https://www.cms.int/saiga/en

Saiga News #26

Saiga News 26 has recently been published (in 6 languages) and contains articles and updates from across Saiga range. It is available to download from: the Saiga Resource Centre: *https://www.saigaresourcecentre.com/content/saiga-news-magazine*

Recently published articles

North Africa

Habitat requirements of the Mhorr gazelle: What does this species need to survive in the wild?

Teresa Abaigar, Cristina Martínez, Zouhair Amaouch, Mohamed Alifal, Ali Lemdimigh, Sid'Ahmed El Makki, Mohamed El Mokhtar, Mohamed L. Samlali, Pablo Fernandez de Larrínoa, & Emilio Rodriguez Caballero Almería (2020)

Global Ecology and Conservation, 24. https://doi.org/10.1016/j.gecco.2020.e01389

Abstract

The mhorr gazelle (*Nanger dama mhorr*) is the westernmost-distributed mama gazelle subspecies and it has been considered extinct in the wild since 1968. Much of the survival of this subspecies depends on its ex-situ captive population and future reintroduction projects. However, this subspecies disappeared before it could be well studied; and most of the knowledge regarding the mhorr's ecological requirements in its native range comes from early observations in the 40s and 50s and are general description of their native habitats. In 2015 a group of mhorr gazelle was released in the Safia Nature Reserve (Morocco) as the first step to establish a long-sustainable wild mhorr gazelle population. This project offered an opportunity to determine the habitat requirements of the mhorr in terms of surface area (size), landscape and the vegetation's characteristics. The results come from seven (2.5) collared adult mhorr gazelles. Once released into the wild, the gazelles explored extensive areas in all directions around the point of release, but they established their territories - understood as the home range - just to the north of the point of release, far from any human presence (borders or roads) and in flat areas where the acacia tree cover was abundant; the core areas were settled also in the most flat and vegetated areas inside the home range. All the gazelles except one female occupy the same region with a very high overlap in their home range (between 28.4 and 75.8%). Regarding the extent of the home range (average 119.9 ± 27.5 km²) and core areas (average 20 ± 4.2 km²) depends on time of sampling and highlight the differences between the space needed by the mhorr gazelles to satisfy their needs in the wild and the space provided for the species in previous reintroduction projects in fenced-off areas.

Central Africa

High abundance and large proportion of medium and large duikers in an intact and unhunted Afrotropical protected area: Insights into monitoring methods

Thomas Breuer, Mireille Breuer-Ndoundou Hockemba, Cisquet Kiebou Opepa, Sarah Yoga & Franck Barrel Mavinga (2021)

African Journal of Ecology, 59: 399-411

Abstract

Unsustainable hunting of bushmeat has dramatic impacts on ecological processes and people's livelihoods. Unfortunately, there is often a strong controversy regarding the sustainability of duiker hunting due to their continued presence in bushmeat markets, on the one hand, and the

predictions of sustainable harvest models for duiker abundance, on the other. This apparent contradiction is largely due to biased low abundance estimates from dung surveys. We present results from a 52.4 km line transect dung survey using site decay rates to estimate duiker densities. In addition, camera trapping (14,995 camera trap-days) was used to provide detection rates and a baseline for the ratio of blue to red duikers as an index of hunting pressure from Nouabalé-Ndoki National Park, with almost zero levels of hunting. Dung surveys revealed high overall duiker densities (totalling 107.4 duikers per km^2) and quick dung decay rate. Camera trapping revealed high-duiker detection rates and a high ratio of red to blue duikers. Pristine protected areas and no-hunting zones continue to act as source habitats for high recruitment of harvested species. We discuss future options for monitoring duikers and applying the ratio of red to blue duikers as an index of the level of duiker hunting.

Estimating forest antelope population densities using distance sampling with camera traps

Rajan Amin, Hannah Klair, Tim Wacher, Constant Ndjassi, Andrew Fowler, David Olson & Tom Bruce (2021)
Oryx, 1-7. https://doi.org/10.1017/S0030605320001209

Abstract

Traditional transect survey methods for forest antelopes often underestimate density for common species and do not provide sufficient data for rarer species. the use of camera trapping as a survey tool for medium and large terrestrial mammals has become increasingly common, especially in forest habitats. Here, we applied the distance sampling method to images generated from camera-trap surveys in Dja Faunal Reserve, Cameroon, and used an estimate of the proportion of time animals are active to correct for negative bias in the density estimates from the 24-hour camera-trap survey datasets. We also used multiple covariate distance sampling with body weight as a covariate to estimate detection probabilities and densities of rarer species. These methods provide an effective tool for monitoring the status of individual species or a community of forest antelope species, information urgently needed for conservation planning and action.

East Africa

Population Status and Habitat Association of Swayne's Hartebeest (*Alcelaphus Buselaphus Swaynei* (Sclater, 1892)) in Maze National Park, Southern Ethiopia

Tolcha Abraham, Simon Shibru & Belayneh Ayechew (2021)
bioRxiv 2021. https://doi.org/10.1101/2021.01.07.425692

Abstract

We investigated the population status and habitat association of the endemic Swayne's Hartebeest (*Alcelaphus buselaphus swaynei* (Sclater 1892)) in Maze National Park, Southern Ethiopia, in 2018 and 2019. Sample count method line-transect was used for the population estimation, while habitat association was made based on the abundance of individuals counted in each habitat. Data were analyzed using descriptive statistics and compared with $\chi 2$ test. The total estimated populations of Swayne's Hartebeest (SHB) in the study period were 1456 and 1492 during wet and dry seasons, respectively showing no seasonal variation. Among the total estimated population, 31% were adult males, 38.46% adult females, 13.97% sub adult males,

15.94% sub adult females and 1.07% young. The number of adult females was higher than the other age groups followed by adult males in both seasons. Significant differences were reported among age and sex structure of population size during both seasons (wet season: $\chi 2$= 58.423, df =3, P < 0.05; dry season: $\chi 2$=534.079, df= 4, P < 0.05). The maximum group size was 36 and the minimum was 1. The ratio of adult males to adult females was 1:1.24 and 1:1.24, sub-adult males to sub adult females was 1:1.16 and 1:1.12, adult males to sub-adult males was 1:0.36 and 1:0.56, adult females to sub-adult females was 1:0.33 and 1:0.49 in the wet and dry seasons, respectively. The male to female ratio was 1:1.22 and 1:1.19 during wet and dry seasons as well. The population trend among ten years were significantly differed ($\chi 2$= 1.708, df= 9, P< 0.05). The SHB was distributed into three types of habitat (riverine forest, open grassland and scattered tree) with significant differences ($\chi 2$=1109.937, df = 3, P < 0.05). The savannah grass land was most preferable habitat followed by scattered tree habitat. Maintaining its critical habitat was highly recommended for sustainability of current population status.

Genetic variation in morphologically divergent mainland and island populations of Soemmerring's gazelles (*Nanger soemmerringii*), Eritrea

Kamal M. Ibrahim, Phillip Conrad Williams, Amy Olson, Roberta Torounsky, Eva Naser, Futsum H. Ghebremariam & Mai A. Masri (2020)

Mamm Res **65,** 403–412 (2020). https://doi.org/10.1007/s13364-020-00480-4

Abstract

This study focuses on the taxonomic, evolutionary and conservation implications of a striking reduction in body size previously observed in an island population of gazelles by comparing the genetic structure of island and mainland populations. Mitochondrial sequence diversity of the mainland population was found to be comparable to that of other true gazelles of East Africa. We discuss this in the context of the prolonged armed conflict in our study region. In contrast, the gazelles on Dahlak Kebir, one of the over 200 islands and islets of the Dahlak archipelago on the Red Sea, were found to be genetically depauperate. Nucleotide and haplotype diversity estimates were a sixth and a third of that of the mainland population respectively. Using estimates of Tajima's D statistic, we inferred that the Dahlak population has undergone expansion after a recent bottleneck. A minimum spanning genealogical network of mitochondrial control region sequences produced testable hypotheses on the route and timing of the colonization of Dahlak Kebir by gazelles from the mainland. Our mitochondrial DNA dataset has resolved the taxonomic ambiguity of the island gazelles. Their genetic distinctiveness and, their striking conformity to the Island Rule that was highlighted in a previous study, are discussed from evolutionary and conservation perspectives.

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

Michael J. Jowers, João Queirós, Rui R. Pinto, Abdullahi H. Ali, Mathew Mutinda, Samer Angelone, Paulo C. Alves & Raquel Godinho (2020)

Zoological Journal of the Linnean Society XX: 1-12 DOI: 10.1093/zoolinnean/zlz174/5700497

Abstract

The hirola antelope (*Beatragus hunteri*) is considered to be the most endangered antelope in the world. In the *ex-situ* translocated population at Tsavo East National Park, calf mortality and the critically low population numbers might suggest low genetic diversity and inbreeding depression. Consequently, a genetic study of the wild population is pivotal to gain an understanding of diversity and differentiation within its range before designing future

translocation plans to increase the genetic diversity of the *ex-situ* population. For that purpose, we assessed 55 individuals collected across five localities in eastern Kenya, covering its entire natural range. We used the complete mitochondrial DNA control region and microsatellite genotyping to estimate genetic diversity and differentiation across its range. Nuclear genetic diversity was moderate in comparison to other endangered African antelopes, with no signals of inbreeding. However, the mitochondrial data showed low nucleotide diversity, few haplotypes and low haplotypic differentiation. Overall, the inferred low degree of genetic differentiation and population structure suggests a single population of hirola across the natural range. An overall stable population size was inferred over the recent history of the species, although signals of a recent genetic bottleneck were found. Our results show hope for ongoing conservation management programmes and that there is a future for the hirola in Kenya.

Evaluation of population status and foraging ecology of Sable antelope (*Hippotragus niger roosevelti*, Heller, 1910) in Shimba Hills National Reserve, Kenya

Benard Ochieng, Benards Okeyo & Fredrick Tamooh (2020)
African Journal of Ecology 58: 446-454.

Abstract

The Sable antelope (*Hippotragus niger roosevelti*, Heller, 1910) is nationally endemic to Shimba Hills National Reserve (SHNR) in Kenya. In the past few decades, its population has declined considerably. Despite the alarming decline and resultant localised distribution, a little information exists on the species population status and foraging ecology. Different ecological research techniques were used to collect relevant data and information on the species population structure and feeding habits. The results showed that Sable population comprised of sex and age structures that are skewed towards females and adult, respectively, whereas young and subadult populations were not significantly different. Seasonal change did not have significant influence on the diversity of food plants selected by Sable. Although crude protein and phosphorous levels in Sable faecal samples differed significantly between the seasons, they were within the recommended minimum maintenance requirements for wild herbivores. The study concludes that Sable has good survival rate and potential to breed but lacks stability in the population. Additionally, Sable forage quality and availability may not be limiting its population growth. There is need to establish management strategies for improving reproduction in Sable and understand the level of competition of the species with other mega herbivores in SHNR.

Long-term historical and projected herbivore population dynamics in Ngorongoro crater, Tanzania

Patricia D. Moehlman, Joseph O. Ogutu, Hans-Peter Piepho, Victor A. Runyoro, Michael B. Coughenour & Randall B. Boone (2020)
PLoS ONE 15(3): e0212530. https://doi.org/10.1371/journal.pone.0212530

Abstract

The Ngorongoro Crater is an intact caldera with an area of approximately 310 km2 located within the Ngorongoro Conservation Area (NCA) in northern Tanzania. It is known for the abundance and diversity of its wildlife and is a UNESCO World Heritage Site and an International Biosphere Reserve. Long term records (1963–2012) on herbivore populations, vegetation and rainfall made it possible to analyze historic and project future herbivore population dynamics. NCA was established as a multiple use area in 1959. In 1974 there was a perturbation in that resident Maasai, and their livestock were removed from the Ngorongoro

Crater. Thus, their pasture management that was a combination of livestock grazing and fire was also removed and 'burning' stopped being a regular occurrence until it was resumed in 2001 by NCA management. The Maasai pasture management would have selected for shorter grasses and more palatable species. Vegetation mapping in 1966–1967 recorded predominately short grasslands. Subsequent vegetation mapping in the crater in 1995 determined that the grassland structure had changed such that mid and tall grasses were dominant. After removal of the Maasai pastoralists from the Ngorongoro Crater in 1974, there were significant changes in population trends for some herbivore species. Buffalo, elephant and ostrich numbers increased significantly during 1974–2012. The zebra population was stable from 1963 to 2012 whereas population numbers of five species declined substantially between 1974 and 2012 relative to their peak numbers during 1974–1976. Grant's and Thomson's gazelles, eland, kongoni, and waterbuck (wet season only) declined significantly in the Crater in both seasons after 1974. In addition, some herbivore species were consistently more abundant inside the Crater during the wet than the dry season. This pattern was most evident for the large herbivore species requiring bulk forage, i.e., buffalo, eland, and elephant. Even with a change in grassland structure, total herbivore biomass remained relatively stable from 1963 to 2012, implying that the crater has a stable carrying capacity. Analyses of rainfall indicated that there was a persistent cycle of 4.83 years for the annual component. Herbivore population size was correlated with rainfall in both the wet and dry seasons. The relationships established between the time series of historic animal counts in the wet and dry seasons and lagged wet and dry season rainfall series were used to forecast the likely future trajectories of the wet and dry season population size for each species under three alternative climate change scenarios.

A descriptive study of zoonotic disease risk at the human-wildlife interface in a biodiversity hot spot in South Western Uganda

Shamilah Namusisi, Michael Mahero, Dominic Travis, Katherine Pelican, Cheryl Robertson & Lawrence Mugisha (2021)

*PLoS Negl Trop Dis*15(1): https://doi.org/10.1371/journal. pntd.0008633

Abstract

Zoonotic diseases pose a significant health challenge at the human–wildlife interface, especially in Sub-Saharan Africa where ecosystem services contribute significantly to local livelihoods and individual well-being. In Uganda, the fragmented forests of Hoima district, form part of a "biodiversity and emerging infectious disease hotspot" composed of communities with high dependency on this wildlife protected areas, unaware of the associated health risks. We conducted a cross-sectional mixed methods study from March to May 2017 and interviewed 370 respondents, using a semi-structured questionnaire from eight villages neighbouring forest fragments in Hoima District, Uganda. Additionally, a total of ten (10) focus group discussions (FGDs) consisting of 6–10 men or women were conducted to further explore the drivers of hunting and perception of zoonotic disease risks at community level. Qualitative and quantitative data were analysed using content analysis and STATA version 12 respectively. We found twenty-nine percent (29.0%, CI: 24.4–33.9) of respondents were engaged in hunting of wildlife such as chimpanzee (*Pan troglodytes*) and 45.8% (CI: 40.6–51.0), cane rats (*Thryonomyidae spp*). Acquisition of animal protein was among the main reasons why communities hunt (55.3%, CI: 50.1–60.4), followed by "cultural" and "medicinal" uses of wildlife and or its parts (22.7%, CI: 18.6–27.4). Results further revealed that hunting and bushmeat consumption is persistent for other perceived reasons like; bushmeat strengthens the body, helps mothers recover faster after delivery, boosts one's immunity and hunting is exercise for the body. However, respondents reported falling sick after consumption of bushmeat at least

once (7.9%, CI: 5.3–11.1), with 5.3% (CI: 2.60–9.60) reporting similar symptoms among some family members. Generally, few respondents (37.0%, CI: 32.1–42.2) were aware of diseases transmissible from wildlife to humans, although 88.7% (CI: 85.0–92.0) had heard of Ebola or Marburg without context. Hunting non-human primate poses a health risk compared to edible rats (cane rats) and wild ruminants (cOR = 0.4, 95% CI = 0.1–0.9) and (cOR = 0.7, 95% CI = 0.2–2.1) respectively. Study suggests some of the pathways for zoonotic disease spillover to humans exist at interface areas driven by livelihoods, nutrition and cultural needs. This study offers opportunities for a comprehensive risk communication and health education strategy for communities living at the interface of wildlife and human interactions.

Southern Africa

South Africa's private wildlife ranches protect globally significant populations of wild ungulates

Andrew Taylor, Matthew Child, Peter Lindsey, Samantha Nicholson, Claire Relton & Harriet Davies-Mostert (2021)

Biodivers Conserv ***30,*** *4111–4135.* *https://doi.org/10.1007/s10531-021-02294-5*

Abstract

Reversing biodiversity loss is a global imperative that requires setting aside sufficient space for species. In South Africa, an estimated area of 20 million ha is under wildlife ranching, a form of private land enterprise that adopts wildlife-based land uses for commercial gain. This land has potential to contribute towards biodiversity conservation, but the extent to which this occurs has not been evaluated. Using structured questionnaires of 226 wildlife ranchers, we assessed how the sector contributes towards the conservation of ungulates and elephants (hereafter herbivores). Overall, 40 herbivore species were present across the sample, where individual ranches had a mean of 15.0 (±4.8) species, 1.9 (±1.5) threatened species, and 3.6 (±3.1) extralimital species per property. In comparison to 54 state PAs, wildlife ranches had significantly higher species richness, more threatened species but more extralimital species when property/reserve size was controlled for. Ranches conducting trophy hunting had similar species richness and numbers of extralimital species per ha, but fewer threatened species when compared to ranches conducting ecotourism. We estimate that 4.66–7.25 million herbivores occur on ranches nationally, representing one of the few examples on earth where indigenous mammal populations are thriving and demonstrating how sustainable use can lead to rewilding. We discuss the potential negative impacts of widespread game fencing on landscape fragmentation and gene flow, as well as how the widespread occurrence of extralimital species may lead to hybridization, biotic homogenization, and changes to vegetation dynamics. Despite these challenges, commercial wildlife ranching offers a viable option for conserving large mammalian herbivore biodiversity.

Identifying the true number of specimens of the extinct blue antelope (*Hippotragus leucophaeus*)

Elisabeth Hempel, Faysal Bibi, J.Tyler Faith, James S. Brink, Daniela C. Kalthof, Pepijn Kamminga, Johanna L.A. Paijmans, Michael V. Westbury, Michael Hofreiter & Frank E. Zachos (2021)

Sci Rep 11, 2100 (2021). https://doi.org/10.1038/s41598-020-80142-2

Abstract
Native to southern Africa, the blue antelope (*Hippotragus leucophaeus*) is the only large African mammal species known to have become extinct in historical times. However, it was poorly documented prior to its extinction~ 1800 AD, and many of the small number of museum specimens attributed to it are taxonomically contentious. This places limitations on our understanding of its morphology, ecology, and the mechanisms responsible for its demise. We retrieved genetic information from ten of the sixteen putative blue antelope museum specimens using both shotgun sequencing and mitochondrial genome target capture in an attempt to resolve the uncertainty surrounding the identification of these specimens. We found that only four of the ten investigated specimens, and not a single skull, represent the blue antelope. This indicates that the true number of historical museum specimens of the blue antelope is even smaller than previously thought, and therefore hardly any reference material is available for morphometric, comparative and genetic studies. Our study highlights how genetics can be used to identify rare species in natural history collections where other methods may fail or when records are scarce. Additionally, we present an improved mitochondrial reference genome for the blue antelope as well as one complete and two partial mitochondrial genomes. A first analysis of these mitochondrial genomes indicates low levels of maternal genetic diversity in the 'museum population', possibly confirming previous results that blue antelope population size was already low at the time of the European colonization of South Africa.

Alarming decline of bovids in Kasanka National Park, Zambia: A case study of the puku antelope (*Kobus vardonii*)

Vera Rduch and Thalia Jentke

Afr J Ecol. 2021;00:1–12. https://doi.org/10.1111/aje.12843

Abstract

Knowledge about antelope populations and their status is a key for conservation. In November 2019, we used distance sampling to perform a re-survey of the bovid species in Kasanka National Park, Zambia, with a focus on the puku (*Kobus vardonii*). Data collection and subsequent analyses were of the same design as in a previous survey in 2009–2010. This allowed for the direct comparison between survey periods, especially for the data collected in November 2010 and 2019. The estimated puku population size decreased from 5,038 (range 3,268–7,238) animals in 2009–2010 to 819 (range 250–2,708) animals in 2019, representing an 84% decline. Smaller group sizes were observed. Changes in population structure (decline in male abundance, fewer male groups) and spatial distribution (decline in population density, especially along the park boundaries) of puku showed signs of increased poaching activities in Kasanka National Park. Also, puku became more vigilant and demonstrated significantly longer flight distances in 2019 in comparison with 2010. A strong decline in puku in combination with clear signs of poaching, as well as the reduced species richness and sightings of other bovids, should become an agenda for long-term conservation of Kasanka National Park.

High diversity, inbreeding and a dynamic Pleistocene demographic history revealed by African buffalo genomes *(in South Africa)*

Deon de Jager, Brigitte Glanzmann, Marlo Möller, Eileen Hoal, Paul van Helden, Cindy Harper & Paulette Bloomer

Sci Rep **11,** 4540 (2021). https://doi.org/10.1038/s41598-021-83823-8

Abstract

Genomes retain records of demographic changes and evolutionary forces that shape species and populations. Remnant populations of African buffalo (*Syncerus caffer*) in South Africa, with varied histories, provide an opportunity to investigate signatures left in their genomes by past events, both recent and ancient. Here, we produce 40 low coverage (7.14×) genome sequences of Cape buffalo (*S. c. caffer*) from four protected areas in South Africa. Genome-wide heterozygosity was the highest for any mammal for which these data are available, while differences in individual inbreeding coefficients reflected the severity of historical bottlenecks and current census sizes in each population. PSMC analysis revealed multiple changes in N_e between approximately one million and 20 thousand years ago, corresponding to paleoclimatic changes and Cape buffalo colonisation of southern Africa. The results of this study have implications for buffalo management and conservation, particularly in the context of the predicted increase in aridity and temperature in southern Africa over the next century as a result of climate change.

The Seroepidemiology of a Neglected Zoonotic and Livestock Pathogen in Free-Ranging Bovids: Leptospirosis in African Buffaloes (*Syncerus caffer*) *(in South Africa)*

Wynand Goosen, Mark Hamish Moseley, Tanya Jane Kerr, Andrew Potts & Michele Miller

Pathogens 2021, 10, 1072. https://doi.org/10.3390/pathogens10091072

Abstract

Multi-host pathogens are challenging to control and are responsible for some of the most important diseases of humans, livestock, and wildlife. Leptospira spp. are some of the most common multi-host pathogens and represent an important cause of zoonotic infections and livestock productivity loss in the developing world, where contact with wildlife species is common. Although there is increasing evidence that cattle in Africa harbour a broad diversity of Leptospira genotypes and serovars, little is known about the epidemiology of these pathogens in wild bovids, such as African buffaloes (*Syncerus caffer*). Using microscopic agglutination testing (MAT) on serum samples collected from free-ranging buffaloes (n = 98) captured in the Hluhluwe-iMfolozi Park (HiP), South Africa, we demonstrated an overall seroprevalence of 21% with seropositivity almost exclusively limited to serovar Tarassovi (serogroup Tarassovi). Moreover, we found no evidence of seropositivity in unweaned calves and showed temporal- or herd-specific variation in exposure risk, and increased probability of seropositivity (OR = 5.44, 95% CI = 1.4–27) in female buffaloes. Together, these findings demonstrate that free-ranging African buffaloes are exposed to Leptospira spp. infections, providing insights into the epidemiology of an emerging Leptospira serovar in herds with an absence of any disease control and minimal management.

Polyclonal antibody–based immunohistochemical detection of intraleukocytic Theileria parasites in roan and sable antelopes

Sarah J. Clift, Bernat Martí-Garcia, Rephima M. Phaswane, Emily P. Mitchell, Antoinette I. Josemans, Ilse Vorster, Katja N. Koeppel & Jeanni Fehrsen (2021)
Journal of Veterinary Diagnostic Investigation. 2021;33(6):1079-1088.
Doi:10.1177/10406387211033272

Abstract

Theileria parasites commonly infect African wild artiodactyls. In rare roan (*Hippotragus equinus*) and sable (*H. niger*) antelopes, *Theileria* sp. (sable)-associated calf mortalities constrain breeding programs. The pathogenicity of most leukocyte-transforming *Theileria* spp. originates in their invasion of and multiplication in various mononuclear leukocytes, the transformation of both infected and uninfected leukocytes, and their infiltration of multiple organs. Understanding the pathogenesis of theileriosis can be improved by the use of immunohistochemistry (IHC) to identify the localization of the parasites in tissue sections. Our aim was to develop a reproducible IHC assay to detect leukocyte-associated *Theileria* parasites in formalin-fixed, paraffin-embedded roan and sable tissues. Polyclonal antibodies were purified from the sera of 5 roans from an area endemic for *Theileria* sp. (sable) and tested for IHC reactivity in 55 infected and 39 control roan and sable antelopes, and for antigen and species cross-reactivity in an additional 58 cases. The 3 strongest antibodies consistently detected intraleukocytic theilerial antigens in known positive cases in roan and sable antelopes, and also detected other *Theileria* spp. in non-hippotraginid wild artiodactyl tissues. The antibodies did not cross-react with other apicomplexan protozoa, with the exception of *Cryptosporidium*. Given that PCR on its own cannot determine the significance of theilerial infection in wild ruminants, IHC is a useful laboratory test with which to confirm the diagnosis in these species.

America

Genetic diversity and structure in Arizona pronghorn following conservation efforts

Erin E. Hahn & Melanie Culver (2021)
Conservation Science and Practice. https://doi.org/10.1111/csp2.498

Abstract

Arizona pronghorn (*Antilocapra americana*) population numbers have declined over the last century due to unregulated-harvest, population fragmentation, urban expansion, and habitat loss. Captive breeding, reintroductions, and translocations have helped to curb decline and boost population numbers of the endangered Sonoran subspecies (*A. a. sonoriensis*). To assess the effect of ongoing management actions on the Sonoran subspecies, we collected multi-locus genotype data and performed tests of genetic differentiation and population structure in comparison to the non-endangered American subspecies (*A. a. americana*). We provide updated estimates of genetic diversity and relatedness to serve as a benchmark for future management toward further recovery of Sonoran pronghorn. Management actions have upheld distinction between the two subspecies in Arizona and stemmed further genetic diversity loss while avoiding an increase in inbreeding within the captive-bred Sonoran population.

Barrier Behaviour Analysis (BaBA) reveals extensive effects of fencing on wide-ranging ungulates

Wenjing Xu, Nandintsetseg Dejid, Valentine Herrmann, Hall Sawyer and Arthur D. Middleton.
2021. *Journal of Applied Ecology* 2020; 00:1–9. https://doi.org/10.1111/1365-2664.13806

Abstract

As human activities expand globally, there is a growing need to identify and mitigate barriers to animal movements. Fencing is a pervasive human modification of the landscape that can impede the movements of wide-ranging animals. Previous research has largely focused on whether fences block movements altogether, but a more nuanced understanding of animals' behavioural responses to fences may be critical for examining the ecological consequences and prioritizing conservation interventions.

We developed a spatial- and temporal-explicit approach, Barrier Behaviour Analysis (BaBA, available as an R package), to examine individual-level behaviours in response to linear barriers. BaBA classifies animal-barrier encounters into six behaviour categories: quick cross, average movement, bounce, back-and-forth, trace and trapped. We applied BaBA to wide-ranging female pronghorn *Antilocapra americana* and mule deer *Odocoileus hemionus* in an area of western Wyoming, USA, with >6,000 km of fencing.

We found both species were extensively affected by fences, with nearly 40% of fence encounters altering their normal movements, though pronghorn were more strongly affected than mule deer. On average, an individual pronghorn encountered fences 250 times a year—twice the encounter rate of mule deer. Pronghorn were more likely to bounce away from fences, whereas deer engaged in more back-and-forth, trace and average movement near fences.

We aggregated these behavioural responses to demonstrate how BaBA can be used to examine species-specific fencing permeability and to identify problematic fence segments in order to guide fence modification or removal.

Synthesis and applications. Our work provides empirical evidence on how fences affect wildlife movement. Importantly, Barrier Behaviour Analysis (BaBA) can be applied to evaluate other linear features (such as roads, railways and pipelines) and habitat edges, enhancing our ability to understand and mitigate widespread barrier effects to animal movement.

Home range size of male dama gazelles, *Nanger dama*, in an ex-situ population in West Texas

Elizabeth Cary Mungall & Susan M. Cooper (2021)
African Zoology, 56:2, 124-132. DOI: 10.1080/15627020.2021.1908845

Abstract

Dama gazelles (*Nanger dama* Pallas, 1766) are critically endangered within their native habitat of northern Africa's Sahelo-Saharan Zone. However, several Texas ranches maintain populations that provide a hedge against extinction and that can provide suitable stock for conservation projects, including reintroduction. For these initiatives, there is a critical need for information on spatial requirements of male dama gazelles. This is especially the case, because population increase is hindered by aggressive behaviour of males kept within limited areas. Adult males kill other males. We report on the spatial distribution and interaction potential (inter-animal distances) of male eastern dama gazelles (*N. dama ruficollis*) from a population living on 8,996 ha of fenced rangeland in West Texas, USA. We fitted five males with GPS-radio collars and tracked their positions every 3 h for one year. Adult males (n = 3) maintained annual 95% Kernel Home Ranges (KHR) averaging 1,783 ha with 50% core areas averaging 440 ha. Average distance between adults with adjacent home ranges was 2.8 to 4.6 km, with only four contacts within 20 m recorded. Subadult males (n = 2) had more diffuse home ranges and a common core area. They only associated in a loose bachelor group for part of the time.

Their space use can overlap with that of adult males. When spatial requirements are met, problems caused by aggression can be minimised. Small sample size prevents definite recommendations, but results point to productive avenues for additional study to enhance management of other *ex situ* populations.

Subspecific identity and a comparison of genetic diversity between wild and ex situ wildebeest *(in North America)*

Lauren M. Caspers, Gina M. Ferrie, Kristen Wolfe & Eric A. Hoffman
Zoo Biology 2020, 39: 129-140. https://doi.org/10.1002/zoo.21530

Abstract
The original North American ex situ wildebeest population was believed to originate from the white-bearded wildebeest (*Connochaetes taurinus albojubatus*), which is both morphologically distinct and geographically separated from the brindled wildebeest (*C. t. taurinus*). However, after an import of wildebeest into North America in 2001, managers have suspected that white-bearded and brindled wildebeest were mixed in herds at multiple institutions. We sequenced the mitochondrial control region (d-loop) from a portion of the managed North American population and compared our sequences with previously published sequences from wild individuals to determine the subspecific identity and genetic diversity of our ex situ population. We were able to confidently identify *C. t. albojubatus* as the subspecies identity of the sampled portion of our population. Within our population, haplotype and nucleotide diversity were low (0.169 and 0.001, respectively) with a single common haplotype (H1) containing 41 of the 45 individuals sequenced, while two rare haplotypes (H2 and H3) were derived from three individuals and a single individual, respectively. Nucleotide and haplotype diversity were greater overall in the wild populations compared with our managed population. However, *C. t. albojubatus* was found to exhibit lower nucleotide diversity in both wild and ex situ populations when compared to other wild subspecies. Though the overall goal of the North American wildebeest population is for public education and not reintroduction, maintaining genetic diversity is vital for the long-term viability of this managed population, which may benefit from periodic supplementation of wild animals.

Asia and the Middle East

An attempt to restore the population of the Goitered Gazelle (*Gazella subgutturosa*) in its indigenous range in the Caucasus (Mammalia: Bovidae)

Elshad Askerov, David P. Mallon, Nugzar Zazanashvilid(†), Vazha Kochiashvilid, Sevinj Sarukhanova & Azerchin Muradov (2021)
Zoology in the Middle East. *https://doi.org/10.1080/09397140.2021.1949137*

Abstract
Since the 1930s, the range and numbers of the Goitered Gazelle *Gazella subgutturosa* declined rapidly in the Caucasus and fell to a critical size in the 1960s when the species became extinct in Georgia and in most parts of the species range in Azerbaijan. After the establishment of target protected areas in Azerbaijan, the number of gazelles significantly increased, but the population is mostly concentrated in the isolated Shirvan protected areas on the Caspian Sea coast, which currently holds more than 10% of the global Goitered Gazelle population. Using Shirvan as a source population, regular reintroduction activities started in the early 2010s: Azerbaijan-

Georgia transboundary area became the priority for the last decade. In total 174 individuals have been translocated and released directly after transportation (hard release) in two sites. At first, growth of the reintroduced population was slow, but now, 7–9 years after the translocation started a clear increase of the population size has been recorded. Today, the total population of the two groups is around 312 individuals (including juveniles). It is expected that with further growth the groups will unify and create a stable, new, transboundary gazelle population.

Rapidly increasing migratory activity of Mongolian gazelle (*Procapra gutturosa*) and the sightings of Goitered gazelle (*Gazella subgutturosa*) in Transbaikalia as an alarm *(in Russia)*

Kirilyuk V.E. (2021)

Russian J. Theriol. Vol.20. No.1. P.25–30. Doi: 10.15298/rusjtheriol.20.1.04

Abstract

Mongolian gazelle (*Procapra gutturosa*) has been recovering in the Zabaikalsky Krai of Russia since 1993–1994. The process, supported by successful conservation measures, was slow at first, but then accelerated rapidly. Establishment of sedentary groups and increase of their abundance on the Russian territory took place with a simultaneous increase of seasonal migrations of transboundary groups. They became annual since 2008. Russian part of the range expanded from 260 km2 in 1998 to 29,700 km2 in 2020. It covers about 90% of habitats suitable for gazelle in the region. In 2019–2020, both the number of antelopes entering Russia and an area they occupy increased the most: not only antelopes wintered in Russia but they also expanded their occurrence on Russian territory during summer time which was unusual previously and led to a rapid increase of resident local groups. Also, barbed wire fence along a state border near the junction of Mongolia and China contributed to increased accumulation of antelopes on the Russian territory. An unusual entry of Goitered gazelle (*Gazella subgutturosa*) from Mongolia to Zabaikaisky Krai was first recorded in January 2020. The adult male was photographed near Solovyevsk station more than 500 km from the nearest part of its current range. My findings show that Mongolian gazelles rapidly concentrate in a disproportionately small part (4%) of their current range i.e., the steppe part of Zabaikalsky krai of Russia. This concentration increases a probability of human-wildlife conflicts in Russia. Moreover, given the limited area of the suitable habitats and large number of natural and artificial barriers, chances of mass mortality among migrating cross-border groups increase dramatically. The observed processes evidence anthropogenic displacement of ungulates from the Mongolian territory due to a growing depletion of the forage supply and other negative drivers. In particular, climate change can increase the dangerous impact of humans. There is an urgent need to implement effective measures for conservation of Mongolian gazelle, based on regular monitoring of populations' parameters that serve as indicators of their sustainability.

Idmi and other Mammalian Wildlife in the Farasan Islands Protected Area

Jorge F. Soares & Torsten Wronski (2021)

Pp. 1323-1355 In: Jawad, L.A.J. (ed.) *The Arabian Seas: Biodiversity, Environmental Challenges and Conservation Measures*. Springer International Publishing, Switzerland. doi.org/10.1007/978-3-030-51506-5_64

Abstract

The Farasan archipelago - like its African counterpart, the Dahlak Archipelago - is a unique assembly of coral-formed islands located on the Farasan Bank at the Arabian site of the southern Red Sea. The rugged surface and the tropical-arid climate form a harsh landscape in which only

a few mammal species have managed to survive. This chapter presents a short overview about the mammal fauna of the Farasan archipelago - comprising only two bat species, one carnivore, one ungulate and two rodent species - and subsequently provides an in-depth insight into the ecology of 'idmi', the Arabian gazelle (*Gazella arabica*), on the Farasan Islands. The archipelago has been protected since 1988, primarily to preserve its Arabian gazelle population, but also for its exceptional conservation value as a marine reserve. The protected area harbours probably the largest population of Arabian gazelles worldwide and represents a phylogenetically distinct population diluted by repeated introductions of mainland Arabian gazelles. After discussing the phylogeny, taxonomy and a putative island dwarfism of the gazelle population, the chapter reports on habitat preferences and the limiting resources. Most recent research on population structure, social organization and population development is summarized and related to the conservation of the gazelles in the Farasan Islands Protected Area. Since competition with livestock and the transmission of zoonotic diseases pose eminent threats to the survival of the population, the interface between domestic animals and the gazelles is highlighted. Finally, the chapter shades some light on the phylogeny and taxonomy of other island dwelling gazelles in Arabian waters.

The conservation history of Arabian gazelles (*Gazella arabica*) in Israel - do fifty-five years monitoring help to define future incentives

Benny Shalmon & Torsten Wronski (2021)
Animal Science, Vol. 1, Chapter 3: 21-38.

Abstract

We aimed to review the population development and conservation history of Arabian gazelles (*Gazella arabica acaciae*) in Israel, to summarise conservation-related research and to provide future recommendations.

1. We researched published online material as well as files and archives of the Israel Nature and Park Authority, compiling old documents, field notes, numerous unpublished reports and photographs.

2. The population development-since monitoring started in 1964 is viewed in a historical context. The conservation history was critically revised and screened for the most eminent threats, including low fawn survival, high predation pressure, low genetic diversity (inbreeding), competition with dorcas gazelles (*Gazella dorcas*) and climate change.

3. We describe what conservation actions were implemented over a period of 30 years, the success and drawbacks of these measures, and what research projects were carried out to facilitate conservation.

4. Based on those results, we aimed to give future recommendations, delineating scenarios that might be useful to reverse the population decline, such as captive breeding and translocations, out-breeding, irrigation, water and food supply, predator control through fencing or culling and parasite surveillance.

5. Finally, we discussed the proposed capitulation, allowing the population to go extinct in the face of further emerging threats like climate change or disease outbreaks. We emphasise the importance of this population for the survival of the species in general, but also for the functional diversity of the hyper-arid desert ecosystem in the southern Negev.

Repeated hybridization of two closely related gazelle species (*Gazella bennettii* and *G. subgutturosa*) in central Iran

Davoud Fadakar, Mansoureh Malekian, Mahmoud R. Hemami, Hannes Lerp, Hamid R. Rezaei & Eva V. Bärmann (2020)

Ecology and Evolution 10(20): 11372-11386. https://doi.org/10.1002/ece3.6774

Abstract

Interspecific hybridization increasingly occurs in the course of anthropogenic actions, such as species translocations and introductions, and habitat modifications or occurs in sympatric species due to the shortage of conspecific mates. Compared with anthropogenically caused hybridization, natural hybridization is more difficult to prove, but both play an important role in conservation. In this study, we detected hybridization of two gazelle sister species, *Gazella bennettii* (adapted to dry areas) and *Gazella subgutturosa* (adapted to open plains), in five habitat areas, where *G. bennettii* naturally occur in central Iran. The hybrids have a nuclear genomic identity (based on two introns), habitat preference, and phenotype of *G. bennettii*, but the mitochondrial identity (based on cyt *b*) of *G. subgutturosa*. We suggest that natural hybridization of female *G. subgutturosa* and male *G. bennettii* happened twice in central Iran in prehistoric times, based on the haplotype pattern that we found. However, we found indications of recent hybridization between both species under special circumstances, for example, in breeding centers, due to translocations, or in areas of sympatry due to the shortage of conspecific mates. Therefore, these two species must be kept separately in the breeding centers, and introduction of one of them into the habitat of the other must be strictly avoided.

Responses of Przewalski's Gazelle (*Procapra przewalskii*) to zinc nutrition in physical habitat *(in China)*

Song C., Jiang Q. & Shen X. (2021)

Biol Trace Elem Res **199,** 142–147. https://doi.org/10.1007/s12011-020-02137-4

Abstract

To study responses of *Procapra przewalskii* to zinc (Zn) nutrition in physical habitat, we analyzed the content of mineral elements in soil, forage, and animal tissues. Physiological and biochemical indexes were also determined. The results showed that Zn contents in the soil and forage from affected pasture were significantly lower ($P < 0.01$) than those in unaffected areas. Zn concentrations in the blood, liver, and hair from affected *P. przewalskii* were also significantly lower ($P < 0.01$) than those in healthy animals. The levels of hemoglobin, erythrocyte count, and packed cell volume from affected *P. przewalskii* were significantly lower ($P < 0.01$) than those in healthy animals. Serum aspartate aminotransferase and alanine transaminase activities were significantly lower ($P < 0.01$) in affected *P. przewalskii* than in healthy animals, while serum lactate dehydrogenase and alkaline phosphatase levels were significantly higher ($P < 0.01$) in affected compared with healthy animals. The activities of superoxide dismutase, glutathione peroxidase, and catalase in serum were significantly lower and the malondialdehyde content was significantly higher (all $P < 0.01$) in affected compared with healthy animals. Affected *P. przewalskii* were treated orally with ZnSO4. The Zn content in the blood increased gradually and serum antioxidant indexes gradually returned to within the healthy range. Zn deprivation in forage thus not only influenced the blood mineral content but also severely disrupted blood parameters and antioxidant function in *P. przewalskii*.

Potential consequences of captivity and environmental pollution in endoparasitic prevalence in different antelopes kept at wildlife parks *(in Pakistan)*

Naz S., Arooj S., Ali Z. & Farooq Z. (2021)

Environ Sci Pollut Res **28,** 16308–16313. https://doi.org/10.1007/s11356-020-11561-x

Abstract

Endoparasites are the potential source of substantial health complications in animals; exclusively the endoparasites of zoonotic importance are of great concern to researchers and health authorities for diverse perspectives. A coprological study was conducted to inspect the endoparasitic infestation in antelopes kept at three captive localities, i.e., Safari Park, Jallo Wildlife Park, and Lahore Zoo, situated in Lahore, Pakistan. There were 109 selected species of antelopes including nilgai (*Boselaphus tragocamelus*), blackbuck (*Antilope cervicapra*), urial (*Ovis orientalis*), and chinkara (*Gazella bennettii*). The fresh fecal samples of each experimental animal from individual and mixed animal enclosures were collected and tested by an appropriate parasitological method. The fecal samples were examined by applying the modified McMaster technique through the Whitlock chamber method and observed by a compound microscope for identification and fecal egg count. The prevalence (%) of egg per gram (EPG) and diversity of endoparasitic eggs identified from fecal samples of experimental animals from three captive localities were recorded. The analysis revealed species from phylogenetic groups of nematodes cestodes and trematodes along with coccidian occurrence. The prevalence of endoparasites was highest in nilgai (*B. tragocamelus*) with combined average prevalence (23.88 ± 3.13) from three captive localities followed by chinkara (*G. bennettii*) combined average prevalence (21.68 ± 2.64), urial (*O. orientalis*) combined average prevalence (21.41 ± 4.69), and blackbuck (*A. cervicapra*) combined average prevalence (16.88 ± 2.66). To prevent such infestations which prevail more intensely regarding changing climate and increasing pollution levels, there should be regular monitoring and appropriate prophylaxis combined with epizootiological investigation for future studies and implication of advance technology, for captive animals so that best possible adaptations can be made to reduce the spread of infective diseases that are of zoonotic importance also.

General

Benefits and pitfalls of captive conservation genetic management: Evaluating diversity in scimitar-horned oryx to support reintroduction planning

Rob Ogden, Justin Chuven, Tania Gilbert, Caroline Hosking, Karim Gharbi, Mark Craig, Shaikha Salem Al Dhaheri & Helen Senn (2020)

Biological Conservation 241. https://doi.org/10.1016/j.biocon.2019.108244

Abstract

The reintroduction of the scimitar-horned oryx to Chad is a multi-disciplinary endeavour, planned and implemented over the past decade, utilizing a wide range of conservation science applications to maximise the chances of long-term population sustainability. The principle of incorporating genetic diversity information into founder selection for species reintroductions is widely recognized; however, in practice, a full assessment of available ex-situ genetic variation is rarely attempted prior to identifying individuals for release. In this study we present the results of over ten years of research analyzing and interpreting the genetic diversity present in

the key source populations for the Chad scimitar-horned oryx reintroduction. Three empirical genetic datasets (mitochondrial DNA sequence, nuclear DNA microsatellite and SNP markers) comprising over 500 individuals sampled from public and private institutions were analysed, accompanied by simulation studies to address applied questions relating to management of the reintroduction. The results strongly demonstrate the importance of conservation genetic analysis in ensuring that founders represent the greatest breadth of evolutionary diversity available. The inclusion of both intensively and lightly managed collections allowed us to bridge the gap between studbook and group managed populations, enabling the inclusion of individuals from populations that lack historic data on their origins, but which may hold unique diversity of significant conservation value. Importantly, however, our study also reveals the potential risks of applying standard population genetic approaches to multiple captive populations, for which small founder sizes are likely to strongly bias results, with potentially serious consequences for the genetic management of conservation breeding programmes.