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Abstracts

Reintroduction project of dorcas gazelle in Senegal: evaluation and assessment after eight working years

Teresa Abáigar¹, Mar Cano¹, Conrad Ensenyat², Marius Niaga³, Babacar Youm³, Lamine Kane³, Jacques Gomis³, Thialao Sarr³, Hugo Fernández².

¹ Estación Experimental de Zonas Áridas/CSIC, Almería, Spain

² Zoo de Barcelona, Barcelona, Spain

³ Direction des Parcs Nationaux, Dakar, Senegal

Keywords: Dorcas gazelles, *Gazella dorcas*, North Ferlo, Guembeul reserve, reintroduction, Senegal.

The project of reintroduction of dorcas gazelle (*Gazella dorcas neglecta*) in Senegal started in 2005 and was designed to be developed in different phases, each phase having partial objectives within a global and final target that is the complete release of gazelles in the wild in the North Ferlo Fauna Reserve (NFFR). At present and after eight years, there is a captive population of 30 dorcas gazelles at the Geumbeul Fauna Reserve (GFR), and a semi-wild population of around 27 individuals living in a 1200 ha surface at the Katané enclosure (NFFR). This project has proven the flexibility of dorcas gazelles to adapt to different management conditions as well as to recover their natural “life style” (feeding, social behavior, habitat use, territoriality) when natural conditions -and no-human intervention- are provided. Unexpected events at GFR (attack of dogs and an abortion epidemic), as well as the mortality by predation of jackals in the Katané enclosure during first year after release, reduced the initial projected growth of these populations. Awareness and involvement of the local population in the conservation of their natural resources –plant and animal species-, as well of the importance of reintroduction projects as a way to recover their natural heritage -unknown by most of them-, has been one of the priorities of this project.

Applying common species (*Jaculus* and *Gerbillus* rodents) for testing theories - the Sahara-Sahel as eco-evolutionary laboratory

Z. Boratyński, CIBIO

North Africa is exposed to fluctuating geo-climatic conditions that continuously shape size of the Sahara-Sahel, exposing local biota to variable and extreme conditions. Environmental changes affect species' distribution and influence population demographic trends leaving marks on genetic and phenotypic level, influencing species' ecology and evolution.

To understand important processes that Sahara-Sahel organisms experience it is crucial both to address flagship organisms and widespread, common, species. The former in urgent need of conservation actions and later as models for asking questions answering which will progress our understanding of local processes. In this respect, some of the broadly distributed Sahara-Sahel small vertebrates, especially those with high and unexplained phenotypic and genetic variabilities, gained research attention. Research on them benefits from high species abundance and detectability, and population densities allowing fast accumulation of data.

The two emerging model systems suitable for eco-evolutionary Sahara-Sahel research are *Jaculus* and *Gerbillus* rodents. New studies on *Jaculus* are suggesting importance of ecologically driven diversification processes. The two lineages, or cryptic species, are sympatric throughout the Sahara-Sahel and seem to be adapted to distinct, although not very well understood yet, micro-habitats that potentially affect reproductive isolation between them. The *Gerbillus* diversity is amongst the highest in mammals, yet its distribution is geographically and ecologically very constrained (to Sahara-Sahel and Middle East), in comparison to other species-rich mammal groups (e.g.: *Microtus* inhabits Europe, Asia, North America, including Mexico). Its high diversity might lie behind crucial processes occurring in North Africa.

Etat des populations de Gazelles de Cuvier, *Gazella cuvieri* (Ogilby, 1841) dans la Wilaya de Tiaret

Bounaceur F¹, Fellous A², Sallai M³, Ghlamallah C¹, Arab Said D¹, Benaboucha N¹, Douba F¹, Chérif K¹, Boualem A¹⁻³, Bounaceur S¹

1. Faculté des Sciences de la Nature et de la Vie. Université Ibn Khaldoun Tiaret Algérie
2. Agence Nationale de la Conservation de la Nature. Alger Algérie
3. Conservation des Forêts de la Wilaya de Tiaret

Mots clés : *Gazella cuvieri*, évaluation des populations, effectifs, répartition, cartographie, Tiaret.

La présente étude porte sur l'état actuel des populations de *Gazella Cuvieri*, dans la région des Hautes Plaines de la wilaya de Tiaret en Algérie occidentale.

Le suivi consiste à un inventaire exhaustif de toutes les communes de la wilaya où une évaluation des populations des effectifs de gazelles observées a été abordée de 2011 jusqu'à 2013, couvrant les parties Nord de la wilaya, jusqu'à la commune de Rahouia au Nord Ouest, en fonction des saisons sur leurs milieux de prédilection avec une analyse du couvert végétal présent.

La répartition et la distribution de *Gazella cuvieri* au niveau de la Wilaya de Tiaret est en cours d'analyse par une cartographie établie à l'échelle des différents biotopes fréquentés par cette espèce. Les connaissances acquises vont contribuer à une meilleure évaluation de ces populations de cette espèce emblématique des zones de collines et de montagnes du Nord de l'Algérie et qui figure parmi les espèces les plus menacées aussi bien en Algérie que dans le reste des pays du Maghreb .

Unravelling biodiversity, evolution and threats to conservation in the Sahara-Sahel

José Carlos Brito,^{1,2} Raquel Godinho¹, Fernando Martínez-Freiría¹, Juan Manuel Pleguezuelos³, Hugo Rebelo^{1,4}, Xavier Santos¹, Cândida Gomes Vale^{1,2}, Guillermo Velo-Antón¹, Zbyszek Boratyński^{1,5}, Sílvia B Carvalho¹, Sónia Ferreira^{1,2}, Duarte Vasconcelos Gonçalves^{1,2}, Teresa Luísa Silva^{1,2}, Pedro Tarroso¹, João Carlos Campos^{1,2}, João Vasco Leite¹, Joana Nogueira^{1,2}, Francisco Álvares¹, Neftalí Sillero⁶, Andack Saad Sow⁷, Soumia Fahd⁷, Pierre-André Crochet⁸, and Salvador Carranza⁹

1 - CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos da Universidade do Porto, Instituto de Ciências Agrárias de Vairão, R. Padre Armando Quintas, 11, 4485-661 Vairão, Portugal.

2 - Departamento de Biologia da Faculdade de Ciências da Universidade do Porto. Rua Campo Alegre, 4169-007 Porto, Portugal.

3 - Departamento de Biología Animal, Facultad de Ciencias, Universidad de Granada, E-18071 Granada, Spain.

4 - School of Biological Sciences, University of Bristol, Woodland Road, Bristol BS8 1UG, United Kingdom.

5 - Centre of Excellence in Evolutionary Research, Department of Biological and Environmental Science, University of Jyväskylä, P.O. Box 35 YAC, Surfontie 9, Finland.

6 - Centro de Investigação em Ciências Geo-Espaciais (CICGE) da Universidade do Porto, 17 R. Campo Alegre, 687, 4169-007 Porto, Portugal.

7 - Département de Biologie, Faculté des Sciences, Université Abdelmalek Essaâdi, Tétouan, Morocco.

8 - EPHE-UMR 5175, Centre d'Ecologie Fonctionnelle et Evolutive, 1919 route de Mende, F-34293 Montpellier-cedex 5. France.

9 - Institute of Evolutionary Biology (CSIC-Universitat Pompeu Fabra), Passeig Marítim de la Barceloneta, 37-49, E-08003 Barcelona, Spain.

The Sahara is the largest warm desert in the world and together with the arid Sahel displays high topographical and climatic heterogeneity, and has experienced recent and strong climatic oscillations that have greatly shifted biodiversity distribution. Over the last decade, there have been an increasing number of studies based on modern geomatic and molecular tools, and broad sampling of taxa of the Sahara-Sahel. This review tracks trends in the knowledge about biodiversity patterns, processes and threats across the Sahara-Sahel, and anticipates research needs for conservation. Studies suggest high endemism rates and relative large number of species, with narrow and fragmented ranges, frequently limited to suitable micro-hotspots. Molecular based studies are unravelling cryptic diversity associated to mountains. Mapping of multivariate environmental variation of the region illustrates main biogeographical features of the Sahara-Sahel and support recently hypothesised dispersal corridors and refugia. Micro-scale water-features present mostly in mountains have been associated to local biodiversity hotspots. Research is providing insights into key-evolutionary and ecological processes, including causes and timing of radiation and divergence for multiple taxa, and associating the onset of the Sahara to diversification processes for low mobility vertebrates. Studies are stressing that biodiversity is threatened by increasing human activities in the region and in the future by predicted global warming. The representation of areas of conflict, landmines, and natural resources extraction, illustrates how human activities and regional insecurity are hampering biodiversity research and conservation. A set of research priorities is provided to identify the framework data needed to support regional conservation planning.

Elephant conservation during and after war: the case study of Mali

Dr Susan Canney*

*Project Leader Mali Elephant Project, The Wild Foundation, Boulder Colorado, USA
Research Associate, Spatial Ecology and Epidemiology Group and the Oxford Tracking Group,
Department of Zoology, University of Oxford, South Parks Road, Oxford, OX1 3PS.

Keywords: Human-elephant conflict mitigation, biodiversity conservation, resilience enhancement, sustainable natural resource management, collaborative approach, livelihoods.

This presentation will describe how the Mali Elephant Project has responded to the seizure of the north by armed groups. Following the coup all government presence vanished from the area - it became lawless, guns proliferated and for the first time elephants were killed. Quick thinking was required to protect the elephants while maintaining the momentum of the project.

We held a four-day community meeting to discuss the main challenges and preoccupations, as well as the threat of elephant poaching, and the strategy developed from there. Some key points were that clan leaders and elders committed to do all they could to prevent poaching by the armed groups, while the young men were recruited to form vigilance networks that gathered information on the elephant killings. They also helped in resource protection activities such as fire-break construction and bush patrols. Although paid only in food, none of these 520 young volunteers joined the jihadi groups, and markedly fewer joined up in areas of the elephant range where the project is active. However, they needed armed back-up, and so we worked with the government to deploy an anti-poaching unit, composed of elite foresters, that would work closely with the community once the area had been secured.

Only six elephants have been killed but the threats continue, not only from armed groups seeking revenue, and elephant-eating tribes just over the border, but also by the return of refugees and post-conflict reconstruction for communities severely riven by the conflict and its aftermath.

The new distribution atlas of mammals from a Moroccan / Saharan Perspective

Fabrice Cuzin, Stéphane Aulagnier & Michel Thévenot

Keywords: Mammals, Morocco, Sahara, distribution.

The 1st edition of this Atlas was published in 1986 by Aulagnier & Thévenot with less than 5,000 observations and with maps drawn on a 0.5 degree grid. This was the largest possible coverage at the time.

The new Atlas presented here is built upon with a global database, covering the whole country, consisting of more than 16,400 observations of terrestrial mammals in Morocco. All the old observations were checked, and southern inland Saharan areas were visited for the first time since the 1950's. The maps were drawn with a more precise grid of 0.25 degrees.

For some species, Saharan distribution maps are shown for the first time, particularly mammals that present special conservation issues (ungulates and carnivores) and bats, of which there was very little previous knowledge.

Finally a more accurate overview of conservation issues for Saharan species will be presented.

Contribution à l'étude descriptive et analytique de la valeur écologique des jardins de la ville de Biskra

*CHAOUCH KOUANE Hind & **BELHAMRA Mohamed

**Maître assistant B-Institut des sciences vétérinaires et sciences agronomiques, Université du Colonel El Hadj Lakhdher-Batna (Algérie)*

***Professeur -Département des sciences agronomiques, Faculté des Sciences Exacte et des Sciences de la Nature et de la Vie, Université de Mohamed Khidher-Biskra (Algérie)*

Mots clés : Biskra jardin, biodiversité, pièges, IPA, inventaire, population.

La dégradation accentuée des espaces naturels, des parcs et jardins en Algérie réclame la conservation et la valorisation de leurs différentes composantes pour les maintenir en équilibre. A Biskra, le jardin botanique « Landon » et le jardin « 5 Juillet » ont connu de longues années d'abandon, malgré qu'ils de toute temps apportent à la ville des Ziban sa prestigieuse réputation et marquent profondément l'histoire de cette ville. C'est les raisons pour les quelles nous avons jugé qu'il est urgent de mener des études sur ces espaces naturelles afin de dresser leur situation. Nous avons abordé l'évaluation de leur valeur écologique par l'inventaire le plus exhaustif possible des végétaux, des oiseaux et des arthropodes qu'ils abritent.

Les résultats sont intéressants et reflètent leurs potentialités écologiques, en effet, l'inventaire floristique du jardin « 5 juillet » nous a permis de recenser 39 espèces végétales appartiennent à 22 familles avec un nombre total de 1851 spécimens, 23 espèces aviennes ont été dénombrées appartenant à 12 familles et 4 ordres et 68 espèces d'arthropodes réparties en 52 familles et 12 ordres. Alors que le jardin « London » a compté 45 espèces végétales appartiennent à 25 familles avec un nombre total de 2926 spécimens, 26 espèces aviennes appartenant à 16 familles et 4 ordres et 115 espèces d'arthropodes réparties en 68 familles et 13 ordres. Les jardins étudiés constituent donc des écosystèmes extrêmement diversifiés, leur richesse spécifique cohérait les mécanismes structuraux de l'écosystème naturel constituant ainsi une biocénose cohérent et structurée.

Résultats préliminaires sur les gangas dans deux sites dans la région de Biskra: Sahara de Nemamecha et Besbes

Farhi K.¹, Belhamra¹ M., Laoufi H.² et Mezerdi F.¹

1 département des sciences agronomiques -université m^{ed} khider biskra-

2 département de science de la nature et de la vie -université m^{ed} khider biskra-

Mots clés: Ganga, habitat, Atlas Saharien, dynamique-population

Les habitats auxquels sont inféodées les populations de Gangas sont caractérisés par des formations steppiques diversifiées représentées par les steppes à alfa et à chamyphites, généralement liées à des reliefs accidentés et à des plateaux à éboulis et des steppes buissonneuses *Halloxymon articulatum*, *Salsola vermiculata* et *Atriplex hlimus*, et/ou à des groupements psammophiles sur des accumulations sablonneuses généralement à base d'*Aristida pengens*, d'*Anabasis articulata*, et de *Limoniastum guyonianums*. Ces écosystèmes ont de tous temps étaient considérés comme une zone de transition et une ligne de démarcation entre les éléments méditerranéens du nord et les éléments typiquement sahariens.

Or, depuis maintenant trois décennies, ces milieux traditionnels accueillant des milliers d'oiseaux tel que les gangas et les outardes, ont subi une dégradation intense et rapide, résultat de la conjonction de facteurs complexes naturels et anthropiques. Cette situation pourrait avoir déjà fragilisé les populations naturelles de Ganga unibande et cata. Malgré l'insuffisance en matière de connaissance des mécanismes fonctionnels et dynamiques des populations naturelles de ces espèces. Mon postulat s'appuie sur le suivi de ces deux espèces dans deux sites de l'atlas saharien (Sahara de Nemamecha et Besbes) et l'identification des causes du déclin de leurs populations.

Result of a survey of wild ungulates in lower Draa valley, Yebel Ouarkiz and Aidar massif, Morocco

Jose María Gil-Sánchez, Abdeljebbar Qninba & Emilio Virgós

Key words: Aidar Massif, Draa river, Morocco, wild ungulates, survey.

As a part of a long-term study in collaboration with the HCEFLCD and l'Institut Scientifique de Rabat, a preliminary survey of wild ungulates was carried out between 2011 and 2013 in the area of Lower Draa valley, Yebel Ouarkiz and Aidar Massiff (Morocco). It is a ca. 20.000 Km² region of rough terrain at the North limit of the Western Sahara desert, where four native ungulates were reported during the nineties. The survey was taken by seven expeditions of one week, with 53 walking surveys (1026 Km) and 20 camera-trapping points. The Cuvier's gazelle (*Gazella cuvieri*) was detected in 75,4% of the surveys, with 45 observed individuals and 4 captured by camera-traps; estimates by *Distance* program offered a density of $0,088 \pm 0,022$ ind. /Km² and a total population of 1063 (95% IC = 629-1795). Hence, it was confirmed as the most important population of this endangered species. The Western Sahara dorcas gazelle (*G. dorcas neglecta*) and the Saharian Barbary sheep (*Ammotragus lervia sahariensis*) were respectively detected in 13,2% and 20,7% of surveys, but collected data were not enough for density estimations (just 5 and 4 respectively observed individuals for each species). The wild boar (*Sus scrofa*) was detected at 15,1% of surveys, just within the margins of the Draa and Chebeikia rivers. This information supports the importance of the area for the wild ungulates of Morocco; however poaching was confirmed to be widespread (detected at 22,5% of surveys), so urgent conservation actions and long term monitoring should be implemented.

Activities and challenges in the Termit & Tin Toumma National Nature Reserve, Niger

A. Harouna, A. Matchano & T. Rabeil (Sahara Conservation Fund)

The creation of the reserve in 2012 by the Niger Government was marked by the end of the ASS project which was financed principally by the French Environment Fund (FFEM), the EU and SCF. Since the reserve was created, the project team aimed to work on the management and conservation plan of the reserve while technical and financial partners (CMS, SCF, Noé Conservation) are looking for financial support, to face new challenges side by side with the Ministry in charge of the Environment. Those challenges are: convince the environmental authorities to allocate the appropriate staff and equipment for the reserve to fight poaching, to create discussion frameworks with all the stakeholders including the oil industry, to revise the game reserves boundaries around the RNNTT. Fortunately, the French NGO Noé Conservation and SCF got Funds from the French Development Agency (AFD) with an innovating project for the three next years. The main activities identified are the capitalization of the experiences of the previous Termit project; the creation of necessary conditions for a community based management of the natural resources, to implement discussion frameworks with petroleum companies with the support of new partners CIRAD and

SHERPA benefiting of great expertise in this field, capacity building for the local representatives and development activities focused on hydraulic, education, health and livestock cares.

Progress and challenges for the North African Ostrich restoration project

A. Harouna, A. Boubacar & T. Rabeil (Sahara Conservation Fund)

The breeding center of the Ostrich project based in Eastern Niger (Kellé) passed under SCF management 18 months ago. Many positive changes are being observed, in terms of eggs production, nutrition quality and monitoring. In October 2011, SCF has recruited a site manager and two bird keepers/guardians. The eggs production passed from nil in the previous years to 45 eggs in 2011-2012. This is due mainly to quality feeds supply, care, and surveillance. Keeping a permanent watch on the site has reduced the risk of fire break out, livestock with herders incursions, and wildlife (crows & vultures) disturbance in search of forage and water. However there are still many challenges to face amongst which we are working on chick production, birds acquisition from other ostrich farms to increase genetic pool, electrification of the site and water supply system.

The role of the UNEP Convention on Migratory Species (CMS) in the conservation of Sahelo-Saharan Megafauna

Borja Heredia UNEP/CMS Secretariat, Bonn

CMS is an intergovernmental treaty that aims to conserve terrestrial, aquatic and avian migratory species throughout their range. Since 1994 CMS has been leading a major international action for the conservation of Sahelo-Saharan species, the so called CMS Concerted Action for Sahelo-Saharan Antelopes (ASS). The aim of this concerted action is to rehabilitate this group of large mammals in order to foster conservation and sustainable development of the region. The program was initially proposed by the Scientific Council of the Convention and then adopted by the Conference of the Parties (COP) in Nairobi in 1994.

In 1998 an Action Plan for Sahelo-Saharan Antelopes was adopted by all the range states at a special meeting in Djerba, Tunisia. This Action Plan has four main objectives: (1) the setting up of the institutional and regulatory framework which would allow to preserve and restore the key Sahelo-Saharan biodiversity elements, in particular the large ungulates; (2) the conservation of natural, residual habitats or the rehabilitation of potential habitats in areas previously occupied by the large ungulates; (3) the direct involvement of local communities in all the activities arising out of the project and its results; (4) increasing awareness among these groups about the benefits of conservation and rehabilitation of wild species as a development factor, building the foundations for the organization of ecotourism in the region, and finally, the rational management and sustainable use of the natural resources thus restored.

In order to implement this Action Plan, two large projects have been developed over the last years, the first one co-financed by the *Fonds Français pour l'Environnement Mondial* (FFEM) over the period 2003-2010, and the second one co-financed by the European Union, FFEM, the Government of Niger, the Sahara Conservation Fund and the *Institut Royal des Sciences Naturelles de Belgique* (IRSNB) during the period 2006-2012.

During this presentation the main outcomes and lessons learned from the implementation of the concerted action will be discussed, with a special emphasis on the designation of the Termit tin Toumma Nature Reserve in Niger in 2012, which has been one of the key milestones of this sustained conservation effort over the last years.

Options for the future role that CMS can play will also be presented, especially regarding the potential for the establishment of a CMS regional instrument on Sahelo-Saharan Megafauna, in the

light of the criteria for CMS new instruments outlined by Resolution 10.16 at the last COP in Bergen (Norway), November 2011.

North African Houbara Bustard restoration program: restocking and maintaining species ecological and behavioural functions

Y. Hingrat (RENECO)

The supportive breeding program run in Morocco by the Emirates Center for Wildlife Propagation aims to restore populations of Houbara Bustard (*Chlamydotis undulata*) in North Africa. Houbaras are artificially bred by equalizing founder representation, maximizing genetic diversity and avoiding inbreeding. Since 1998 more than 54 000 houbaras have been released, with a mean survival above 50% one year after the release and above 80% in subsequent years. Long term population monitoring confirmed the ability of captive bred released (CBR) houbaras to reproduce in the wild with breeding success similar to wild houbaras. Based on these parameters PVA models revealed that protected reinforced or reintroduced populations are intrinsically increasing and viable. However, these models rely on the assumption that ecological and behavioural functions are maintained in CBR houbaras. Alteration of these functions can affect the effective population size through at least three mechanisms: reducing the population size; reducing the population growth rate, and/or by increasing reproductive skew. To verify this assumption, we used a multidisciplinary approach with sound ecological (habitat use and diet) and behavioural studies (mating system, post-fledging, natal and breeding dispersal) conducted on wild and CBR houbaras. Our results confirm the preservation of the species ecological and behavioural functions, and emphasize the reliability of our projected viability models.

Census and sex-ratio of Sahelo-Saharan antelopes reintroduced in Senegal and Tunisia: an update

A. Jebali (EWA)

Key words: census, sex-ratio, Sahel-Saharan antelopes, Senegal, Tunisia.

The Sahelo-Saharan zone had lost during the twentieth century many of its large fauna. Wild ungulates were the most affected by this erosion. To counter this loss some countries such as Senegal and Tunisia established reintroduction projects of the extinct species since the 1980's. Re-introduced antelopes were the Mohor gazelle (*Nanger dama mhor*), the Scimitar-horned Oryx (*Oryx dammah*) and the Addax (*Addax nasomaculatus*). Monitoring of the species was imbalanced between the two countries and some of the protected areas harboring the reintroduced species were less supervised. In this paper we present an update of the number and sex-ratio of the antelopes in the two countries. To achieve this target two surveys one in Senegal and the other in Tunisia were undertaken in 2012. The populations of Mohor and Scimitar-horned Oryx in Senegal were 31 (4.5.16) and 155 (37.13.105) respectively. The census in Tunisia revealed that this country harbored in the end of November 2012: 206 (67.108.31) Scimitar-horned Oryxes, 160 (67.83.10) addaxes and only 3 males of Mohor Gazelle. Besides these antelopes other species such as the Dorcas Gazelle (*Gazella dorcas*), Reem Gazelle (*Gazelle leptoceros*) and Red-necked ostrich (*Struthio camelus camelus*) were also the subject of an unsystematic census.

Evolution and Biogeography of North-West African Foxes

João Vasco Leite¹, Raquel Godinho¹, José Carlos Brito¹, Guillermo Velo-Antón¹, Francisco Álvares¹

¹CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Campus Agrário de Vairão, 4485-661 Vairão, Portugal

North-West Africa's biodiversity is still poorly understood and the majority of existing studies in the region have focused on the phylogeographic history of small-sized and low dispersal taxa, for which barrier effects may be more pronounced. In this study, we combined mtDNA markers (Cyt-b and D-loop) and autosomal microsatellites (22-29 *loci*) to infer phylogenetic patterns and molecular diversity of four fox species: *Vulpes pallida* (first ever molecular data produced), *V. rueppellii*, *V. vulpes* and *V. zerda*. The first three mentioned species are morphologically similar and can be found in distinct, yet successive, biogeographic regions, namely in the Sahelian (*V. pallida*), the Saharo-Sindian (*V. rueppellii*) and Mediterranean regions (*V. vulpes*). A previous ecological modelling study predicted broadly parapatric ranges and potential sympatry zones between *V. rueppellii* and either *V. pallida* or *V. vulpes*, where gene flow between sympatric populations and/or competition may be occurring, probably mediated by environmental and human-related factors.

In general, we found significant levels of genetic diversity but lack of biogeographical structure (except *V. vulpes* in the Maghreb). Phylogenetic analysis of mtDNA yielded surprising results, clustering *V. rueppellii* within one of two *V. vulpes* clades, while microsatellites clearly separate these two taxa. We hypothesize that *V. rueppellii* may represent a more arid adapted ecotype of *V. vulpes*. The overall absence of biogeographical structuring of genetic diversity is most likely linked to the high dispersal capacity of these species. North Africa seems to be a stage for complex evolutionary processes in canids.

Enhancing captive breeding of the scimitar-horned oryx through enclosure design

Marshall, A.R.^{1,2}, Athorn, M.^{1,2}, de Belle, S.², Gilbert, T.³

¹ CIRCLE (Centre for Integration of Research, Conservation and Learning), Environment Department, University of York. E-mail: andy.marshall@york.ac.uk

² Flamingo Land Ltd., Kirby Misperton, North Yorkshire, UK

³ Marwell Wildlife, Winchester, Hampshire, UK

The scimitar-horned oryx (*Oryx dammah*) was once known from arid areas across North Africa, but is now extinct in the wild due to over-hunting, habitat loss and competition with domestic livestock. However, hope for the long-term restoration of *O. dammah* to the wild lies with approximately 14-19,000 individuals that remain in captivity. 70 animals have been already released into fenced protected areas in Tunisia, Morocco, and Senegal. Reintroduction is also planned at sites in Niger and Chad. The total semi-wild population in range countries now stands at less than 500 individuals. Here we outline a new study of captive population health for *O. dammah*, using birth rates, infant survival and behaviour to evaluate the success of zoo exhibit design for promoting breeding and welfare. Populations held for conservation breeding in European zoos have increased from 229 in 1989 when the EEP was founded to 421 in 2013, with 76 animals born during 2012. Husbandry guidelines (Gilbert & Woodfine 2004) recommend maintenance of *O. dammah* in exhibits with a combination of grass and hard surfaces, with good access to natural light, shelter and water. To date,

no statistical analysis of the effectiveness of zoo exhibits for encouraging breeding and behavioural welfare has been completed.

The study uses a combination of questionnaire surveys sent to 54 zoos from across the world, together with behavioural observations, and expert knowledge from animal managers. Here we present the content of the questionnaire, including a summary of zoo responses so far. We also present new data on scimitar-horned oryx behavioural responses to visitors at the UK's most visited zoo. Research observations and predictions are discussed in terms of optimal features for the design and husbandry of *O. dammah*. We are also extremely keen to get input from field teams working with this species.

Application of Remote Sensing and ecological models to understanding biogeographical patterns in Saharan species at local scale: the case of *Cerastes cerastes* and *Cerastes vipera* in Mauritania

Fernando Martínez-Freiría¹, João Campos¹, José C. Brito^{1,2}

1. CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos da Universidade do Porto. Instituto de Ciências Agrárias de Vairão. R. Padre Armando Quintas. 4485-661 Vairão Portugal.

2. Departamento de Biologia da Faculdade de Ciências da Universidade do Porto. Rua Campo Alegre, 4169-007 Porto, Portugal.

Key-words: *Cerastes*, ENM, habitat features, Mauritania, Remote Sensing.

The Sahara desert presents great variability of habitat features that may be related to biogeographical patterns in species distribution. However, such variability is usually not captured in habitat-related variables derived at global scales (e.g., Globcover land-cover). General lack of accurate species distribution observations further hampers the identification of factors that may be related to distribution at local scale. This work studies distribution patterns of two viper species, *Cerastes cerastes* and *Cerastes vipera*, inhabiting the Atlantic coastal desert of Mauritania. Fine-scaled ecological models (1x1 km resolution) were derived based over 55 records collected from field work (between 2003-2012) and literature, and distance to habitat features obtained from two different sources: (1) the ESA Globcovermap, which accounted for four uncorrelated variables, and (2) an unsupervised classification of satellite images from Landsat 5 TM, which accounted for four uncorrelated variables. Model performance was higher when both datasets of variables were combined than when used separately. The observed distribution of both species was related either to distinct habitat factors (e.g. *C. cerastes* by presence of rocks, *C. vipera* by presence of gravel-sand transition) or to similar variables (e.g. short distance to dunes), the latter favouring the occurrence of sympatry. Different profiles of response curves for similar variables were found, suggesting an allopatric distribution at local scales.

The current study contributes to a better understanding of biogeographical relationships among Saharan species, but more robust Remote Sensing procedures are needed to improve discrimination between selected habitats by both species.

Un suivi de l'évolution de l'énergie métabolisable de la Perdrix Gambra (*Alectoris barbara*, BONNATERRE, 1792) en captivité et la dynamique de la population dans la Réserve de chasse de Zéralda.

MEZERDI Farid¹, FARHI Kamilia¹ & BELHAMRA Mohamed¹

¹Département des Sciences Agronomiques, UMK Biskra

Mots clés : Perdrix Gambra, espèce, gibier, énergie métabolisable, chasse, population, Zéralda, réserve, densité, biologie, écologie.

Le gibier sauvage comme les espèces du genre *Alectoris* restent le plus estimé et le plus chassable dans le monde. En Algérie, la Perdrix Gambra *Alectoris barbara* (BONNATERRE, 1792) ne fait pas l'exception. Le signal noté dans ces dernières années est le déclin dans leurs densités, ce qui juge l'importance de maintenir et restaurer cette population dans leurs habitats.

Le volet recherche en laboratoire, nous a permis de contrôler l'évolution des poussins avec la suivi de leurs énergies métabolisables chez les deux lignées (rapide et lent). Pendant dix semaines, la moyenne de l'énergie métabolisable, chez la lignée rapide est passé de 4,2017Kcl/j $\pm$ 0,232 à 36,007Kcl/j $\pm$ 3,028, et de 3,758Kcl/j $\pm$ 0,165 à 31,033Kcl/j $\pm$ 2,949 chez les lents. Le volet recherche en nature dans un milieu à étage bioclimatique sub-humide (la réserve de chasse de Zéralda) est de suivre la dynamique de population de cette espèce. Cette étude consiste d'un dénombrement des couples, et recherche des nids au Printemps et un recensement des compagnies en Été pour élaboration d'un plan de chasse.

En Printemps, Nous avons obtenu une densité 11,22 couples/100ha, La taille de ponte moyenne est de 11,8 œufs/nid. En Été, la taille moyenne de ces groupes varie de 5 à 18 oiseaux, l'âge ratio (J/A) ou le nombre moyen de jeunes par adulte est de 5,6.

A partir de ces résultats, nous avons conclu qu'il faut maintenir et restaurer cette population avec un programme national de gestion des populations naturelles. Mais, ceci n'est réalisable que par la réalisation d'un plan de prélèvement et les connaissances de la biologie et de l'écologie de l'espèce.

Modeling the habitat suitability of Houbara bustards to optimize reinforcement plans and predict potential future impacts of climate change

Monnet A. C.¹, Hardouin L. A.², Hingrat Y.³, Robert A.¹, Jiguet F.¹

¹UMR 7204 MNHN-CNRS-UPMC – « Conservation des espèces, restauration et suivi des populations », Muséum National d'Histoire Naturelle, 55 rue Buffon, 75005 Paris, France

²Emirates Center for Wildlife Propagation, PO Box 47, 33250 Missour, Morocco

³RENECO Wildlife Consultants LLC, PO Box 61741, Abu Dhabi, U.A.E.

Keywords: reintroduction, Houbara bustard, habitat suitability, climate change, Species Distribution Model.

Habitat Suitability Models (HSM) are useful tools for predicting potential current or future species distribution. The last improvements in this methodological framework provide new opportunities for long-term restoration of biodiversity, and particularly in the case of translocation of endangered species. Predictions of HSM can precede the assessment of habitat quality in the field to select priority areas for reintroduction. They have the advantages of accounting for both the ecological requirements of a species for habitat and the potential future impacts of environmental change on its distribution. However we have no insight on their relevance for conservation planning yet. The

general weakness of post-release monitoring prevents to test the effect of integrating the predictions of HSM on translocation success.

Here, we focused on the study case of the reinforcement of the North African Houbara bustard (*Chlamydotis undulata*) in Morocco. We mapped the species habitat suitability from presence data of wild populations using the ensemble forecasting framework BIOMOD. Then we analysed dispersal and survival of captive-bred released Houbara according to the predicted spatial variations in habitat suitability with two approaches. First, we analysed the survival of 957 released Houbara from the intensive post-release monitoring with VHF transmitters from 2001 to 2010. Second, we performed an experimental release of 76 released Houbara equipped with GPS transmitters along the gradient of suitability.

This is the first analysis, to our knowledge, which links the dispersal through habitat suitability with individual survival. It provides a step towards a better understanding of the relevance of HSM for conservation planning.

Biodiversity and biogeography in the genus *Gerbillus*, a marker of the Saharo-Sahelian area: New data obtained due to the integrative approach.

A. Ndiaye*

*IRD, UMR CBGP, Campus de Bel-Air, BP 1386, Dakar, CP 18524, Sénégal & Département de Biologie Animale, FST, Université Cheikh Anta Diop, BP 5005, Dakar, Sénégal.

Keywords: biogeography, ecology, *Gerbillus*, taxonomy, Saharo-Sahelian area.

The Sahara is the largest hot desert in the world, covering nearly 9 millions of km². Considered very recent as an arid desert, it has experienced significant changes in climatic and / or environmental conditions in its history that have shaped the evolution of the species and communities inhabiting it. Rodents of the genus *Gerbillus* are particularly adapted to the Old World arid and semi-arid areas, comprising between 35 and 40 currently recognized species. Often very similar morphologically, many of them have broadly sympatric distributions, but they locally occupy ecological niches that may differ. After a brief presentation of the main characteristics of the genus *Gerbillus*, we will present the state of knowledge on its species diversity and distribution in the dry lands of Africa. We will show how the use of a wide range of methods of analysis of the systematics of the genus, applied to large samples of wide-ranging geographical origin has improved the characterization of species, as well as the knowledge of their geographical distributions. In particular, the use of molecular and cytogenetical methods has led to significant advances in these areas that we will illustrate by examples from Mali, Morocco and Senegal, the latter country representing an area of recent invasion of rodent genus in Africa.

Are there populations of the Mediterranean stripe-necked terrapin (*Mauremys leprosa* Schweigger, 1812) on the Sahara desert?

Paulo Pereira^{1,2}, Joana Veríssimo^{1,2}, José Teixeira¹, José Carlos Brito¹, Guillermo Velo-Antón¹

1 - CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Campus Agrário de Vairão, R. Padre Armando Quintas, 4485-661 Vairão, Portugal.

2 - Faculdade de Ciências da Universidade do Porto. Rua do Campo Alegre s/n, 4169-007 Porto, Portugal.

The Mediterranean stripe-necked terrapin, *Mauremys leprosa*, can be found in various climatic zones of the Mediterranean, from humid to arid environments. Two sub-species were described across its distribution: *Mauremys l. leprosa* present in south-western Europe and north of the Atlas Mountains in Morocco; *Mauremys l. saharica* present in southern Morocco, eastern Algeria and Tunisia. The species has been reported from three localities in the Sahara: 1) in Mauritania it was once reported in Fderick but it is currently considered extinct, nonetheless, some authors do not rule out the possibility that it may be present between Kiffa and Ayoun el Atrous; 2) in Niger it has been mentioned in four localities in the Aïr mountains; and 3) in Libya it has been recently mentioned in the south-western region, probably in the Murzuk oasis, but available mapping is too coarse (1° degree cells) to infer a precise locality. Field sampling is need to determine the status of populations in Niger and Libya and molecular studies are needed to determine local population structure and possible cryptic diversity. In Niger, misidentification with *Pelomedusa subrufa olivacea* may occur, given that this terrapin spreads over the Sahel and presents also isolated populations in the Aïr. We highlight the importance of such remote populations when trying to unveil the evolutionary history of this species, emphasizing that such areas should be considered as priority of sampling surveys. We also provide obvious morphological differences between these two species, in order to ensure the correct identification of *Mauremys leprosa*.

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

Marie Petretto, Adbelkader Chetoui, Guy Parker & Tim Woodfine
Marwell Wildlife, Colden Common, Winchester, Hampshire, SO21 1JH, UK

Key words: Reintroduction, carrying capacity, vegetation, grazing, biodiversity.

Reintroduction of arid-adapted antelopes has been carried out in a number of fenced protected areas across North Africa. Regardless of size, finite areas impose limits on population performance, so protected area managers must eventually intervene or risk numbers decreasing as carrying capacity is reached or exceeded. Too few animals will leave the population vulnerable, but too many animals will lead to habitat degradation and undermine broader goals to maintain biodiversity. The latter may be particularly acute in systems recovering from being previously over-grazed. Carrying capacity is difficult to determine because the condition of arid-lands fluctuates with erratic rainfall. However, it is possible to monitor grazing pressure using simple, low cost methods that provide information for adaptive management. This approach is being tested in the 8,000 ha Dghoumes National Park in Tunisia where a founder population of 16 scimitar-horned oryx has grown to approximately 70 animals within five years. The application of these methods is discussed.

Atlas of Termit & Tin Toumma National Nature Reserve

Thomas Rabeil* & Vincent Turmine

*Sahara Conservation Fund

Keywords: mapping, Niger, biodiversity, reserve, management.

The Termit project named in French "*Projet Antilopes Sahelo-Saharien*" has reached its main objective during its last year of execution: the gazettelement of the Termit & Tin Toumma National Nature Reserve. The fruit of a process initiated in 2004 under the guidance of Niger's Environment Ministry and UNEP's Convention on Migratory Species (CMS), work initiated with funds from the French Global Environment Facility (FFEM) and the European Union and technical support from the Sahara Conservation Fund (SCF) and Belgium's Royal Institute for Natural Resources (IRSNB) has now lead to the reserve's creation.

In order to capitalize all the data and information collected during this 6 years project, an atlas is being elaborated. This atlas is widely illustrated by many maps & pictures and aims to point out the exceptional biological and anthropogenic richness of this area. Indeed, the reserve hosts some of the world's most endangered species, including the addax antelope (*Addax nasomaculatus*), the dama gazelle (*Nanger dama*), the Barbary sheep (*Ammotragus lervia*) and a small population of the elusive Saharan cheetah (*Acinonyx jubatus*). The reserve also covers a large variety of desert habitats, ranging from mountains and valleys to grassy plains, open desert and sand seas.

Therefore, the atlas is composed by 3 chapters describing the geographical component of the Termit Massif & the Tin-Toumma desert, the outstanding biodiversity of the reserve, and the human component including the main challenges to manage this protected area properly and sustainably.

Conservation genetics of arid land antelope at Al Ain Zoo – the next chapter!

Helen Senn¹, Lisa Banfield², Rob Ogden¹

1. WildGenes Laboratory, RZSS, Edinburgh, UK 2. Al Ain Zoo, Al Ain, Abu Dhabi, UAE

Key words: Conservation genetics, Genetic management, Captive breeding, Inbreeding

In partnership with the WildGenes Laboratory at the Royal Zoological Society of Scotland, Al Ain Zoo, United Arab Emirates, is conducting genetic research into a number of arid land species in its collection. This work has two key aims:

1. To place the collection in a global context: How related are animals at Al Ain Zoo to other captive and wild populations? How genetically diverse are they? How valuable is the collection to conservation?
2. To use genetic tools and information gained from the research to implement management changes at Al Ain Zoo that will improve the management of the species in its collection.

We report, at the end of the second phase of this work, on the genetic screening of Arabian oryx, scimitar-horned oryx, addax, dama gazelle, speke's gazelle and 'Nubian' giraffe. We highlight the key findings and management recommendations that have emerged. In association with results from a number of other projects we also present the most recent picture of genetic diversity in global populations of Arabian and scimitar-horned oryx, addax and dama gazelle.

Non-invasive molecular procedures to identify domestic and wild endangered North African Ungulate species

Teresa Luísa Silva^{1,2,3*}, Diana Castro¹, Raquel Godinho¹, Paulo Célio Alves^{1, 2}, Teresa Abáigar³, José Carlos Brito^{1,2}

1. CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Campus Agrário de Vairão, 4485-661 Vairão, Portugal. * tsilva@eeza.csic.es
2. Departamento de Biologia, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre s/n, 4169-007 Porto, Portugal.
3. Estación Experimental de Zonas Áridas, Consejo Superior de Investigaciones Científicas, Crta Sacramento s/n, 04120-La Cañada de S. Urbano, Almería, Spain.

Keywords: conservation genetics, endangered ungulates, non-invasive genetic sampling, North Africa, species identification.

Accurate species identification is crucial for studies using non-invasive sampling and is widely used in the study of elusive and rare wildlife species. Species identification is essential to guide conservation actions and molecular genetics is an important tool for such diagnosis. The vast majority of past molecular tests were only useful to identify species when they were taxonomically well defined; moreover, they required multiple time-consuming laboratorial procedures. Presently, powerful technologies and precise procedures are available for species identification, even from relative small samples of deteriorate material, such as faeces or bones. Most available protocols use mitochondrial DNA (mtDNA), a widely studied marker for barcoding, which is especially sensible to nuclear inserted copies, high intraspecific diversity or heteroplasmy. Other molecular markers (e.g., nuclear DNA, nDNA) provide less material and are less prone to degradation and damage over time, a key factor when working with non-invasive methods. In this work, it was developed a molecular test, based on polymorphisms detected in two small gene fragments of cytochrome b (mtDNA) and kappa-casein (nDNA), to identify nine ungulate species (wild and domestic) cohabiting North Africa. These fragments exhibited different variable sites (including specific sites for each analysed species), allowing the individual identification of selected taxa. The sequences were consistent in the identification of over 600 samples, including faeces and bones collected in the field. The method is of usefulness for the management and conservation of wildlife, based on its simplicity, reliability, and low cost.

Preliminary genetic characterization of two North African gazelle species: Slender-horned gazelle (*Gazella leptoceros*) and Cuvier's mountain gazelle (*Gazella cuvieri*)

Teresa Luísa Silva^{1,2,3}, Raquel Godinho¹, Paulo Célio Alves^{1, 2}, Teresa Abáigar³, José Carlos Brito^{1,2}

1. CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Campus Agrário de Vairão, 4485-661 Vairão, Portugal. * tsilva@eeza.csic.es
2. Departamento de Biologia, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre s/n, 4169-007 Porto, Portugal.
3. Estación Experimental de Zonas Áridas, Consejo Superior de Investigaciones Científicas, Crta Sacramento s/n, 04120-La Cañada de S. Urbano, Almería, Spain.

Keywords: conservation genetics, *Gazella cuvieri*, *Gazella leptoceros*, genetic diversity, non-invasive genetic sampling.

Wide-ranging North African gazelles have undergone strong population declines. There is lack of quantitative knowledge on distribution of suitable habitats, ecological niche parameters, range regression, genetic structure, and landscape barriers for gene flow.

This preliminary work aims at determining genetic diversity in *Gazella leptoceros* and *Gazella cuvieri* in their North African range (Morocco, Algeria and Tunisia). Both invasive and non-invasive molecular methods were used to sequence a fragment of mitochondrial DNA (mtDNA) on different managed populations (wild, semi-captive and captive). Close phylogenetic relationship were found between both gazelles according to mtDNA. Preliminary results corroborate their historical origin: The *G. leptoceros* from the Antwerp zoo come from Tunisia and have the same haplotype found in the country, while the *G. cuvieri* from Finca Experimental “la hoyá”-Almeria (Spain) only have two haplotypes, according to the two founder-females and share the same genetic characters with Moroccan samples, from they were original from. Results show that wild populations of *G. cuvieri* from Morocco and the captive population maintained at “la hoyá” exhibited higher levels of genetic diversity than the wild population of Tunisia, which probably descend from a single “founder” opulation. The captive population of *G. leptoceros* from Brezina (Algeria) does not reveal high levels of genetic diversity, but share the same haplotype with the wild populations from Algeria. These data should be taken into consideration in order to better implement conservation action plans for both species in their wild-range.