SAHELO-SAHARAN INTEREST GROUP

SIXTH ANNUAL CONFERENCE

11 – 13 May 2005

Parc de la Haute Touche

Obterre (France)

Table of Contents

Page No.

Status of the Scimitar-horned Oryx (*Oryx dammah*) and Other Wildlife in the Ouadi Rimé-Ouadi Achim Game Reserve, Chad, between 1972-1977

John Newby, Chief Executive Officer, Sahara Conservation Fund

The aim of this presentation is to present and share data collected in the Ouadi Rimé-Ouadi Achim Game Reserve (Chad) between 1972 and 1977 on the scimitar-horned oryx (*Oryx dammah*). This historical data may be useful as a baseline for comparison with recent surveys and as input for decision-making on future oryx restoration and reintroduction activities. Lessons learned from the period in question may also be of use for future work.

The following extract from my diary gives a flavour of what things were like in the reserve in the mid-1970s:

> *"Headed eastwards between wadis Oum Hadger and Kochili – an area of dune with Panicum grass and Acacia trees. Two large herds of oryx seen – 48 and 58 – and many more tracks. Continue south to the Wadi Hawach – pasture very green. Eight more oryx seen and fresh tracks of 2 horses and 3 camels found. We follow tracks westwards until nightfall."*
>
> *"After an early start catch poachers 20 km west of the camp. They had killed 2 female oryx and one dama gazelle. Women and children released, men taken into custody."*
>
> Ouadi Rimé–Ouadi Achim Game Reserve, 5-6 May, 1975

The following are some salient facts regarding the Ouadi Rimé-Ouadi Achim Game Reserve:

- Established 1969 for oryx, dama gazelle and ostrich
- Area of 77,950 km²
- 'Abandoned' in 1977 due to civil war
- Partially occupied by Libya from 1980-82
- Larger ungulates now virtually gone, with the oryx now extinct in the wild
- Dorcas gazelles still present in good numbers (SSIG 2001, Megaflyover 2004)
- Habitat still good but under threat from over-grazing and increase in wells
- Threats also exist from poaching and foreign hunting/falconry parties
- Restoration and rehabilitation of the reserve a high priority, especially for the dorcas gazelle
- Opportunities exist for captive-breeding and reintroduction

During the 1970s I was able to collect a large quantity of wildlife data from over 500 days fieldwork on camelback and from vehicles. The data set includes 274 data entries for scimitar-horned oryx, reflecting 7774 sightings. Comprehensive information on plants, mammals and birdlife was also amassed.

Over the past few months, I have been able to undertake a new analysis of the data collected, including for the first time the use of GIS technology and satellite imagery. The figures that follow, present information on the seasonal and annual distribution of the oryx, as well as comparative data on the relative abundance and frequency with which oryx and other large mammals were encountered.

Figure 1 shows the data points for all 274 oryx sightings. The data collected points to the following conclusions:

- Oryx migrate northwards in the wet/cold seasons and southwards during the hot season

- Onset of migration is rainfall and pasture dependent as is duration of stay in winter/summer quarters
- Shade is a factor in hot season distribution
- Oryx range between habitats that can be classified as north-Sahelian in the hot season to sub-desert in the cold. They rarely penetrate either true desert or savanna habitats (see Figure 2)

During the 1970s, oryx were not uncommon and could be encountered frequently. Figures 3 and 4 present data on the relative abundance of oryx and other wildlife recorded over a 99.5 day period. For oryx the following can be stated:

- Oryx were encountered on 40% of days travelled
- 2508 individuals were counted in 39 days
- Average of 25 oryx per day overall (range 1-721)
- 1 oryx encountered every 0.25 km travelled on average

As can be seen, both dorcas and dama gazelles enjoyed considerable population sizes and were frequently encountered (97% and 76% of days travelled during the 99.5 day period respectively).

Analysis of the data on oryx permit a certain number of conclusions to be drawn regarding herd size and calving periodicity (Figures 5 and 6). Both of the aspects are useful to understanding the natural dynamics of the species in a context relating to current reintroduction efforts. In the wild, oryx herd size is quite variable, ranging from singletons to vast congregations whilst on migration or concentrated into favourable areas of grazing. As can be seen in Figure 5, however, a simple analysis of herds of less than 50 head (herds larger than this are assumed to be aggregates of several herds) show an 'average' herd size of between 10-20 head.

Data on the presence of young calves in the oryx herds observed (Figure 6), tends to confirm zoo data suggesting that oryx breed every 9 months or so, and continuously under favourable conditions.

Apart from generating useful information on the wildlife of the Ouadi Rimé reserve, the work carried out in Chad during the 1970s contributes to reflection on a number of pertinent conservation issues:

- Are local people part of the problem or the solution? And how can we move them from one side of the equation to the other?
- The value of science and scientific observation
- The need for long term commitment (sites, issues) to deal with short term 'turbulence'
- Multi-disciplinary integrated approaches are essential
- Partnership is essential at all levels
- There is no blueprint for conservation and no 'one size fits all'
- Dealing with 'turbulence' is important
- Building capacity to cope with change is capital

The issue of 'turbulence' can be described and simplified as follows:

- Not simply conflict or civil war but also ensuring
- Continuity in funding (project "stop/go", donor support and loyalty, etc.)
- Continuity in political and local support
- Continuity in management
- Impact of natural phenomena (droughts, desertification)
- Highly dynamic and 'mobile' resource base (time, space, quality, quantity)

The building of capacity is key to dealing with turbulence and creating a higher degree of continuity and ability to address instability.

- We can't do much about war but we can invest in continuity, self-sufficiency and sustainability
- Empowering local people to protect and conserve nature. This may well be interpreted as disempowering others and so care is needed to work out mutually acceptable and functional definitions of roles and responsibilities
- Building capacity (individual and institutional)
- Growing self-sufficiency for management (funding, manpower, formal & informal institutions)
- Increasing incentives (political, social, material) for conservation and responsible management

In general, we need to find and try out new models for conserving aridlands wildlife that are better adapted to the mobility of species such as the oryx and the people that live with them. Can we envisage reserves without boundaries, for example? Addressing 'ownership' issues is also critically important. Supporting legislation and empowerment (definition of rights and responsibilities) are needed.

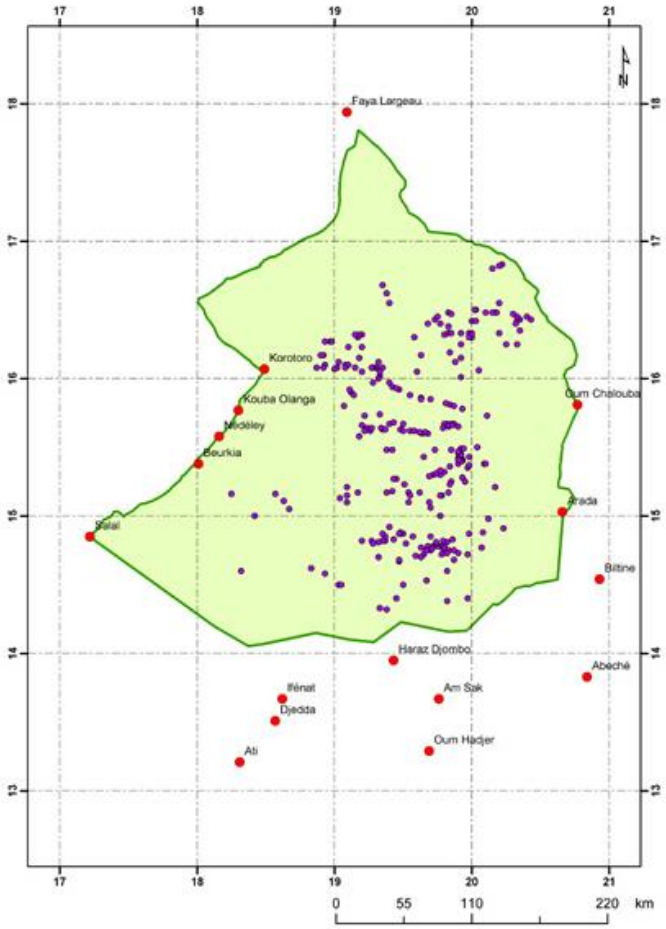


Figure 1. Distribution of scimitar-horned oryx observed between 1972 and 1977, Chad.

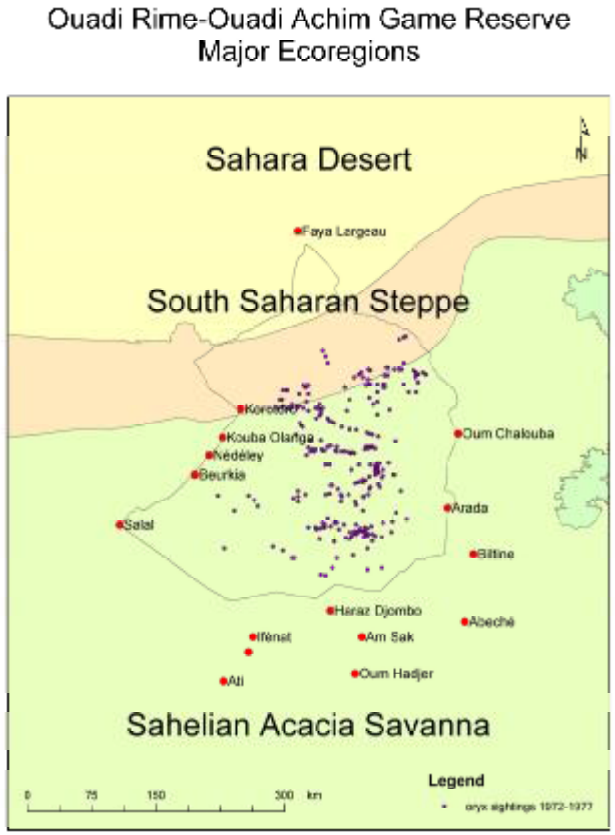


Figure 2. Distribution of scimitar-horned oryx observed between 1972and 1977, Chad, in relation to major desert ecoregions.

	Total	AM	PM	Avg	Oryx/day			Oryx/km			Km/oryx		
					Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
All days	99.5				25.21			0.25			4.04		
Oryx days (39.20%)	39	29	22		64.31	1	721	0.75	0.01	0.56	1.33	0.23	159.00
Oryx seen	2508	1575	933										
% oryx AM/PM		62.80	37.20										
km all days	10140	5877	4263	102									
km oryx days	3344	1858	1486	86									

Figure 3. Abundance and frequency with which oryx were observed during 99.5 days fieldwork (1975–1977).

Species	Total	Days	RF	RA	Avg	Max	Min
Scimitar-horned Oryx	2508	39	39.20%	15.73%	64.31	721	1
Addax	314	7	7.04%	1.97%	44.86	144	1
Dorcas Gazelle	10573	96	96.48%	66.31%	110.14	590	2
Dama Gazelle	2202	76	76.38%	13.81%	28.97	145	1
Red-fronted Gazelle	21	7	21.00%	0.13%	3.00	6	1
Cheetah	5	2	5.00%	0.03%	2.50	3	2
Spotted Hyena	1	1	1.01%	0.01%	1.00	1	1
Striped Hyena	25	14	14.07%	0.16%	1.79	6	1
Golden Jackal	155	53	53.27%	0.97%	2.92	12	1
Fennec	30	18	18.09%	0.19%	1.67	4	1
Pale Fox	28	15	15.08%	0.18%	1.87	6	1
Rüppell's Fox	2	2	2.01%	0.01%	1.00	1	1
Caracal	1	1	1.01%	0.01%	1.00	1	1
African Wild Cat	10	9	9.05%	0.06%	1.11	2	1
Honey Badger	2	2	2.01%	0.01%	1.00	1	1
Ostrich	68	22	22.11%	0.43%	3.09	7	1

Figure 4. Relative frequency (RF) and relative abundance (RA) of 15 species of larger mammal, and the ostrich (n=15,945) recorded over 99.5 days between March 1975 and April 1977, Ouadi Rimé-Ouadi Achim Game Reserve, Chad.

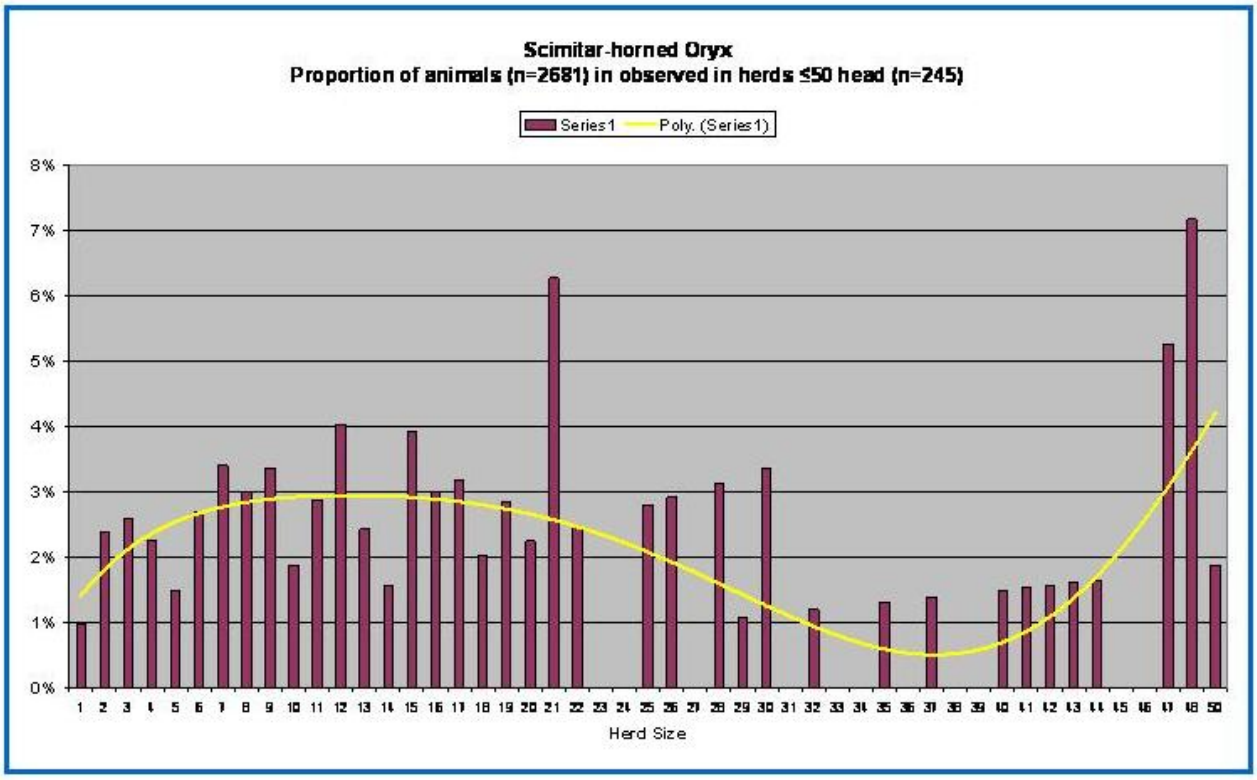


Figure 5. Oryx herd size: proportion of animals observed in herds of less than 50 head.

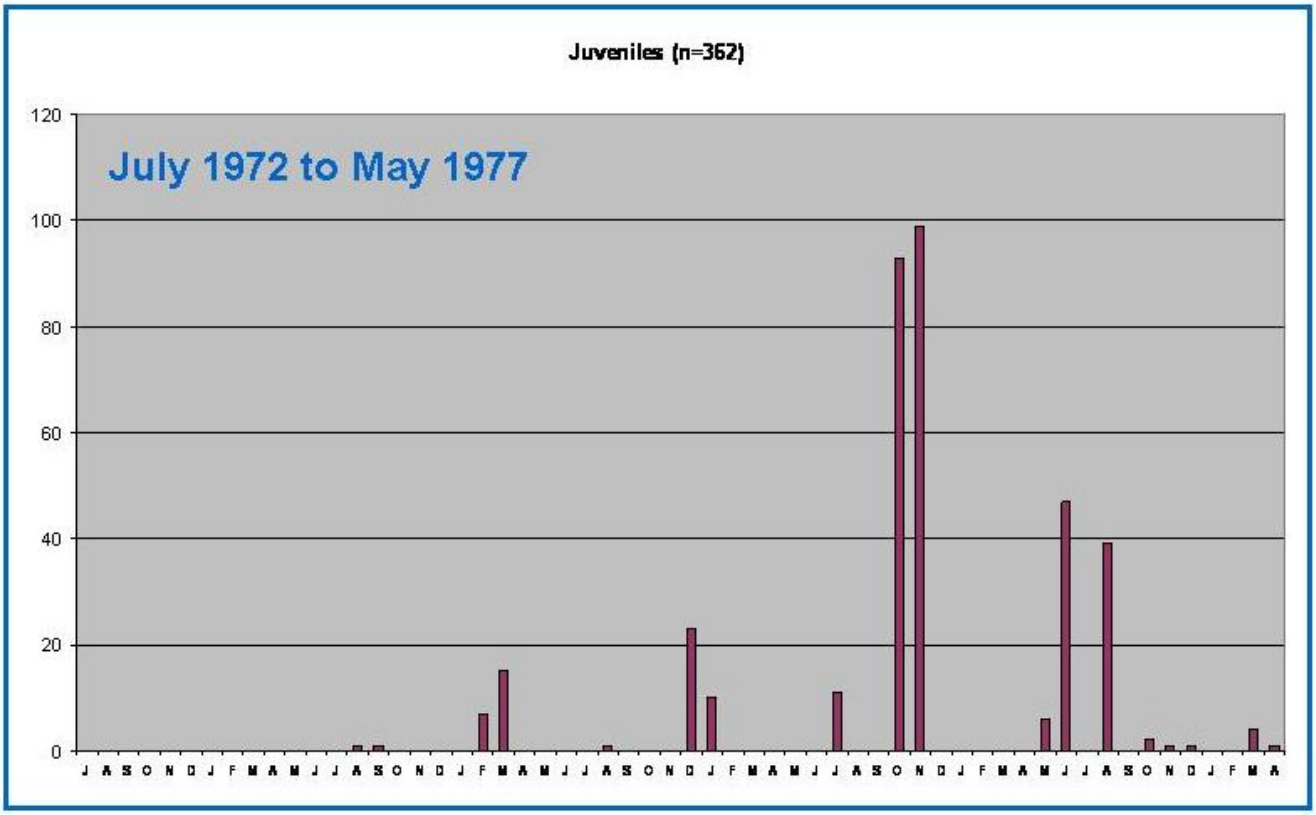


Figure 6. Numbers of scimitar-horned oryx calves observed by month (July 1972–May1977).

Activity Report of the CMS Sahelo-Saharan Antelopes Concerted Action 2004-2005
SSIG meeting, La Haute-Touche, may 2005
Roseline C. Beudels and Arnaud Greth, IRSNB

1. CMS/FFEM SSA project: an update of coordination of activities given by regional coordinator, Arnaud Greth. Activities, as well as a summary of activities and prospects presented country by country (mainly Tunisia, Niger, Mali, Mauritania).

2. Prospects for additional funding for Termit project: contacts with Dutch "African Parks Foundation" through H. Muntingh, Herbert Prince, Laurentine van Oranje.

3. CHAD
   - New perspectives in 2005: inventories based on recent results from Megaflyover, north Kanem / Ennedi, to be coordinated by Bertrand Chardonnet.
   - Need to identify and develop project(s), if possible a regional project, including trans-border issues with Niger (Termit); Libya?
   - Identify funding sources: possibilities explored with EU. Need to prepare proposal.

4. SENEGAL
   - CMS subvention to help with Ferlo and Gueumbeul operation in 2003-2004.
   - Evaluation of progress (Marwell and IRSNB) to be conducted in 2005-2006; second part of CMS subvention to be allocated on further activities after evaluation mission.

5. SSA Database
   - Copy of database available at SSIG meeting: please consult with Dilou (Marie-Odile Beudels, IRSNB); comments/advise most welcome.

6. Website:
   Please consult, comment, advise. Contact Marie-Odile Beudels, IRSNB.

7. Egypt
   - Need your thoughts on potential involvement of CMS: Siwa oasis?

8. Publications and presentations in 2004-2005
   - November 2004: World Conservation Congress, IUCN, Bangkok.
   - "Restoration of the North African Desert Migratory Megafauna: A major conservation and development challenge." R.C. Beudels, P. Devillers, J. Newby and A. Greth.
   - To be published by CMS Secretariat.

9. Upcoming needs/events:
   - Letter/Report on impact of high level poaching on Saharan wildlife (to be done by WCS?) for CMS Scientific Council.
   - Updated Status reports/ maps: to be published by CMS for next COP; SSIG's input requested.
   - New species to be added to the Appendices (Soemmerings gazelle, Barbary sheep, north-African cheetah); others?
   - MoU on SSA requested by Range States: to keep in mind.
   - For information: new Proposal accepted at last Sc C meeting: Concerted Action on Eurasian desert and semi-desert mammals.

Update on Sahelo-Saharan Antelope Conservation Project, CMS/FFEM
Arnaud Greth & Roseline Beudels, SSA CMS/FFEM Project,

SUMMARY

An update of the SSA CMS/FFEM project activities and prospects was presented country by country (mainly Tunisia, Niger, Chad, Mali, Mauritania).

Concerning Tunisia, a mission was done by Dr. B. Chardonnet to prepare oryx and addax translocation between protected areas, in line with Douz SSA conservation strategy and in partnership with the zoo community. Various project documents were also developed to prepare the addax reintroduction project in Djebil National Park and identify future financial partners. The institutional capacity building for the SSA project was also carried forward.

Concerning Niger, the project was delayed in 2004/2005 due to changes at the national coordination level. A new vision was discussed with DFPP, the institutional framework was finalized and partnerships were initiated (*Association Française des Volontaires du Progrès, SCF, SOS Faune du Niger, etc.*). An awareness strategy for SSA conservation was also discussed.

Reports on progress for surveys in Mali (*Office National de la Chasse et de la Faune Sauvage*), Mauritania and Chad (in preparation) were also given.

As emphasized during the previous SSIG meetings, the SSA CMS/FFEM project would welcome a strong partnership with SSIG. The new start up, the Sahara Conservation Fund, will very likely give us the opportunity to strengthen our links and make operational our partnership.

Overview of Wildlife Survey in the Hoggar and Tassili National Parks, Algeria
Tim Wacher & Koen De Smet

GAZELLE AND CHEETAH SURVEY, PARC NATIONAL DE L'AHAGGAR ALGERIA

INTRODUCTION

A wildlife survey of the central region of the Ahaggar National Park was undertaken between 5th and 24th March 2005. The survey took place following preliminary discussions with the Ministry of Culture, Algiers and in the context of a formal invitation from the Director of the Office du Parc National de l'Ahaggar, Mons. Farid Ighilahriz.

The objective of the survey was to conduct a reconnaissance of the central & eastern zone of the park, obtain simultaneous information on cheetahs and their prey base (principally dorcas gazelle) and obtain up to date information about rare or extinct antelopes known from the region (dama and addax). These objectives extend the efforts of SSIG to update distribution and status information about rare Saharan wildlife, and develop internal interest in Cheetah conservation within Algeria, following surveys sponsored by Agence Nationale pour la conservation de la Nature (ANN) and IUCN in 2001.

The 12 strong survey team included 6 national park staff members from OPNA, 2 members of University de Béjaïa and a representative of ANN from Algeria, with SSIG participants from Nature Division, Ministry of Flemish Affairs, Belgium , the Cheetah Conservation Fund, Namibia, and Zoological Society of London. OPNA also supplied two vehicles, drivers and guides, while SSIG hired a third vehicle and fuel. Other funding was contributed through SSIG by St. Louis Zoo, Cheetah Conservation Fund and Zoological Society of London.

The first day was spent at Tamanrasset. A formal introductory meeting between SSIG survey team members and the Director of OPNA was followed by three SSIG presentations, giving an overview of SSIG and its goals, the activities and objectives of the Cheetah Conservation Fund in Namibia, and a résumé of methods employed by SSIG on previous extensive surveys in Chad and Niger.

METHODS & TRAINING

The current survey was organised as an exploratory reconnaissance. Careful attention was paid to recording observation effort (time searching and distances covered) to obtain simple indices (encounter rates, presence absence by geographic unit), but no attempt was made to set up a formal sampling frame to make estimates of absolute abundance. Observations of interest were located as stored waypoints classified to pre-determined categories (landscape, vegetation, wildlife, livestock and human activity), and subsequently allocated to half degree grid square and 5km sector along the survey route (see Fig.1).

Equipment used on the survey included Garmin GPS 12, Kestrel 4000 hand held weather station, Leica 1200 rangefinder, lap-top computer and 2 Trailmaster camera trap units including one TM1550 active infrared and TM 550 passive infrared units. Field training was given in use of all these features, including daily GPS downloads, throughout the survey.

RESULTS

Observation conditions: Following heavy rain on the day of arrival at Tamanrasset, the first half of the survey period was characterised by bright warm days with clear skies and cold nights. Moderately higher wind speeds in the latter half of the survey resulted in light to moderate haze on some days, but wildlife observation conditions were generally good with good opportunity to locate fresh tracks following rain.

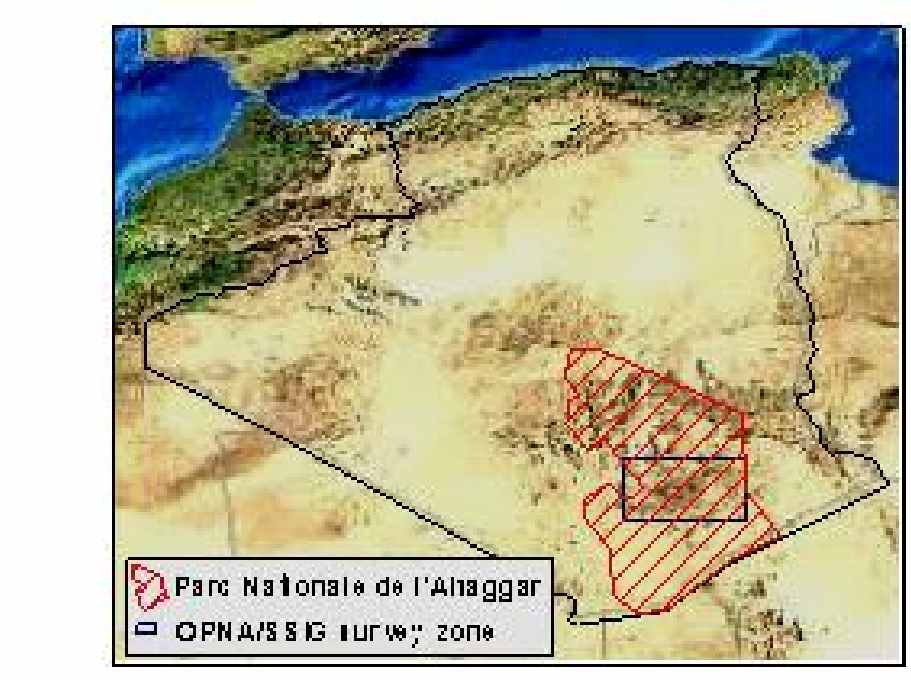


Fig. 1 Parc National de l'Ahaggar and location of survey zone in south-eastern Algeria (left) and details of survey zone, route and camp site locations, in relation to half degree grid squares and 158 '5km' sectors. SSIG/OPNA survey, Ahaggar National Park, March 2005

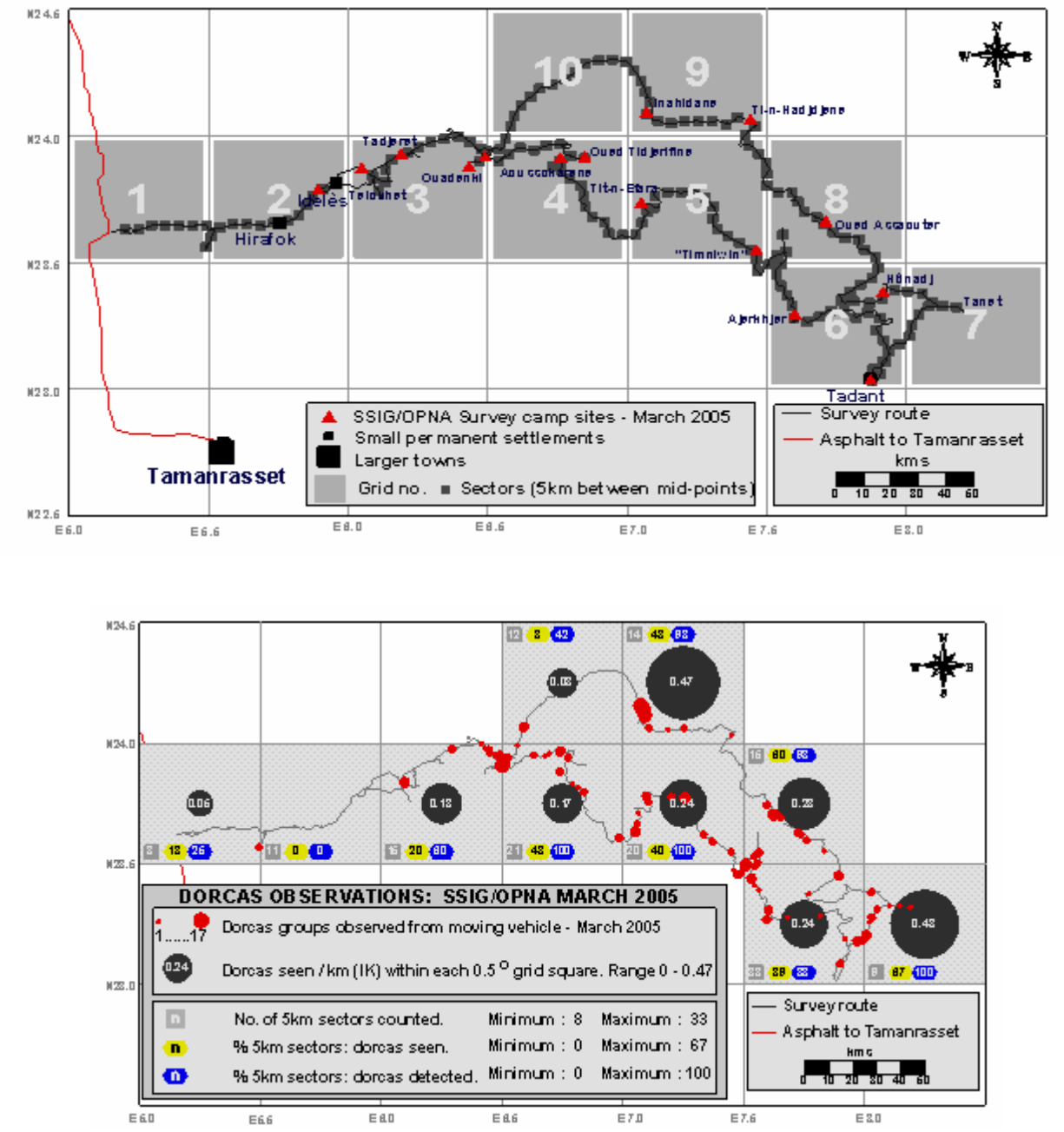


Fig. 2 Distribution of all exact locations of dorcas gazelle *Gazella dorcas* sightings, with encounter rate and detection rate data / 0.5° square also displayed. OPNA/SSIG survey of Ahaggar National Park, March 2005. and detection rate

Survey Route: The survey route ran north and east of Tamanrasset, across the northern and eastern sides of the main Ahaggar mountain massif (Fig. 1). Of >1300km covered off asphalt, 1003kms were covered entering 'fresh' ground, divided into 158 evenly spaced sectors located by fixing centre points at 5km line of site separation.

Habitats: The survey took place primarily in steep sided mountain wadis, while more open plains areas were usually dominated by scattered granite boulder fields. The survey route was thus frequently constrained to travel along drainage lines, and consequently along lines of vegetation. Natural and artificial water points were encountered regularly along the route.

Vegetation: The desert vegetation was generally sparse and dry, though herbs and grasses were seen to be responding to the recent rainfall through the course of the survey. Tree cover was dominated by *Acacia raddiana*, and *Tamarix aphylla*. Mature specimens of both were regularly inspected for sign of cheetah activity (large predator scat and tracks). The latter especially tends to form thickets on high sandy mounds which provide excellent cover, shade and vantage points for cheetah.

Dorcas gazelle: Of 263 Dorcas gazelles counted in total, 234 were seen on 34% of the '5km' sectors covered and in 90% of the half degree grid squares visited (Fig. 2). Mean group size was 2.6, ranging from 1-17. Rate of encounter (0.23 gazelles/km) was found to be moderate compared to most other SSIG survey areas further south, but probably represent a healthy population in this habitat. With hares, donkeys and Barbary sheep, the potential cheetah wild prey base appears to be good.

Cheetah: No cheetahs were observed on the survey, but their presence was detected through observation of fresh and clear tracks at three sites and possible tracks at two more sites (Fig. 3). Presence of large predator scats, sometimes placed on tree branches, were also recorded and samples collected for hair and DNA analysis. The 2 day old corpse of a young camel killed by a cheetah was shown to the team by local people at the end of the survey, and presence of genuine cheetah track and other characteristics of a cheetah kill were verified.

The team also documented additional cheetah observation records collected since the ANN/IUCN survey of 2001, most notably some video footage made by OPNA staff of a young cheetah captured by local people in Tafedest (to the north of the survey area) in March 2004. OPNA released this individual back to the wild after making a photographic record.

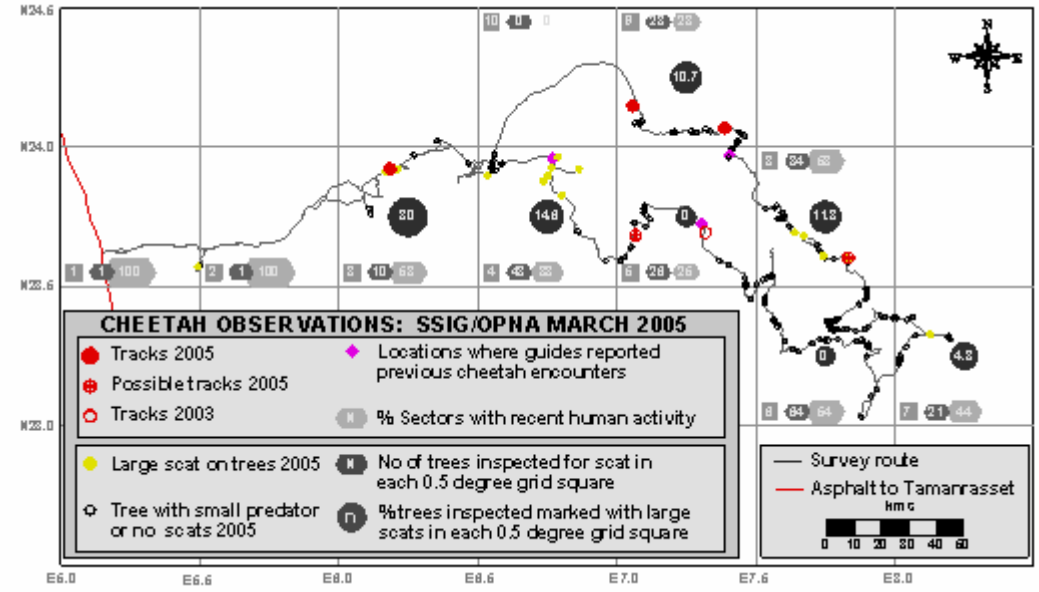


Fig. 3 Distribution of cheetah *Acinonyx jubatus* signs and detection frequencies. SSIG/OPNA reconnaissance survey, Ahaggar National Park, March 2005.

In summary the survey was able to document certain or probable cheetah presence on 10% of 5km sectors covered and in 7/10 half degree squares visited. Combined with other verifiable reports from the passed 4 years the survey team confirmed current presence of cheetah over a >10,000km^2 area of Ahaggar National park and learnt of continuing anecdotal accounts of recent cheetah presence over a much larger area beyond the survey zone, including Tassili National Park and further north in Algeria.

Livestock: Comparative information on livestock distribution showed camels, small stock and donkeys (part feral) to be distributed throughout the gazelle range. Camels were seen at marginally increased frequency in the east, small stock and donkeys in the more mountainous centre and west of the survey.

Discussion with local people, including our OPNA guides, indicated that cheetahs are not considered a problem to small stock management. Small stock are corralled at night; guard dogs associate full time with sheep and goat herds and herdsmen or women also accompany herds full time in the day, preventing cheetah attacks. However camels are managed free range, spending long periods in isolation. In this case cheetahs are considered to be a problem and the survey team witnessed the fresh remains of a 4-6month old camel calf killed by cheetah.

CONCLUSIONS

Dorcas gazelles were seen at moderate frequency but consistently over a wide study area. Combined with other natural prey species it appear they probably do provide a reasonable prey base for a Saharan cheetah population.

Opportunities to census the Ahaggar gazelle population size more rigorously will consistently be constrained by lack of freedom to sample properly in the mountainous terrain.

Excellent evidence of continued cheetah presence in Ahaggar was obtained from local people, the OPNA authorities and our own observations, showing that cheetahs are distributed over at least 10,000km^2 (probably more), but nothing at present is known about cheetah numbers in this area.

It is noted that while cheetahs are not considered a threat to small stock management in present conditions, local concern is expressed about their negative impact on free range camel populations.

CONCLUSIONS AND RECOMMENDATIONS

Despite some limited poaching and security issues, Ahaggar National Park supports an internationally important population of Saharan cheetahs and ungulates, and provides unique opportunities to study and conserve them based on available technical skills, field equipment and financial resources associated with the Office du Parc Nationale de l'Ahaggar.

1. In view of this the survey team recommends that SSIG/SCF pursues a Memorandum of Understanding with the parks managing authority, the Ministry of Culture, in order to facilitate future collaboration.

2. It is recommended that efforts be made to priorities cheetah studies in the Ahaggar, focusing on a detailed study of cheetah livestock interactions and cheetah and the

natural prey base, supported by efforts to improve cheetah detection techniques (scat analysis and camera trapping) in this environment.

3. Further development of collaboration in staff training at all levels in wildlife survey and monitoring techniques is recommended , at both OPNA and in other areas of Algeria, notably the neighbouring Tassili National Park (OPNT). A joint SSIG/OPNT survey would provide and excellent opportunity to extend the training initiated in this survey while generating more data on cheetah distribution and investigating former addax habitats in Algeria.

4. A field survey of the steppe and dune habitats in north-western Algeria is also recommended to follow recent verbal reports of cheetah in that area, and also assess dorcas and slender-horned gazelle status.

5. SSIG should consider the facilities at OPNA headquarters, Tamanrasset as a venue for a future annual meeting. A major subject of that meeting should be to review in detail options for reintroduction of extinct antelopes in Algeria, prioritising dama and addax, for which good contemporary range documentation during the 20th century exists. The situation for scimitar-horned oryx, should also be assessed, noting that 20th century range data are very limited for this species in Algeria, suggesting it should be of lower priority. Options for developing public awareness and education through the facilities at OPNA headquarters at Tamanrasset should be explored.

Addax and Scimitar-horned Oryx in Tunisia: Metapopulations and Modeling

Ed Spevak, Mammal Conservation Program Manager, Cincinnati Zoo & Botanical Garden, Scimitar-horned Oryx SSP Coordinator

Metapopulations

The term metapopulation was first defined by Levins (1969) as subpopulations that exist in discrete habitat patches and that these subpopulations may turnover with extinctions and recolonizations from other patches. Today it has been used to define any population with spatial subdivision. As a working definition a metapopulation is a population composed of a series of populations that interact through migration, i.e. emigration and immigration. Various conceptual models of a metapopulation have been described in order to visualize population relations, e.g., classical metapopulation, patchy population, and source-sink or island model (Figures 1, 2, and 3).

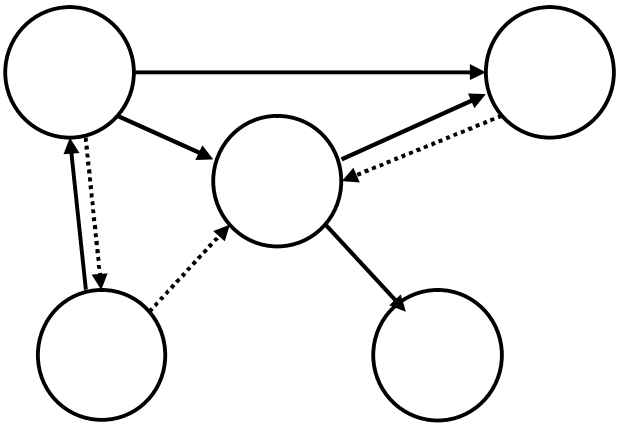


Figure 1. The classic metapopulation has several populations that interact through migration. Migrations can be uni-directional (one-way) or reciprocal or bi-directional (two-way). Migration rates may be of varying rates. Dashed lines indicate lower migration rates then solid lines.

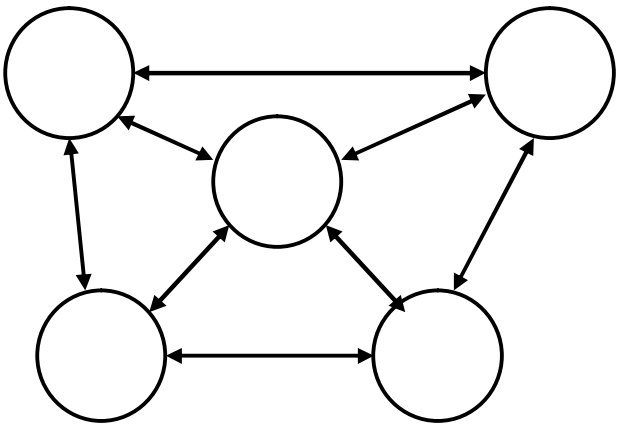


Figure 2. Patchy population. Each individual subpopulation is of approximately equal size and all individual movements (migrations) between populations are reciprocal and relatively equal between neighboring populations.

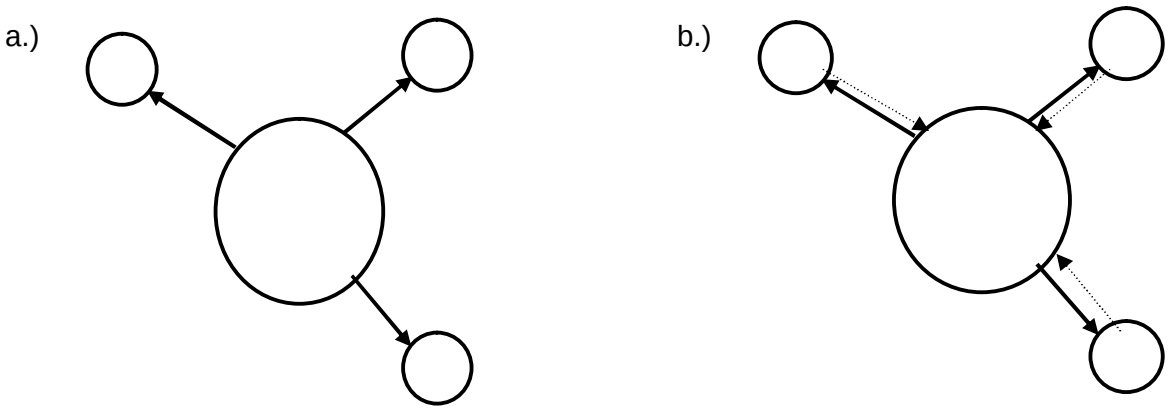


Figure 3. Core-satellite or Island Model metapopulation. The metapopulation is composed of a large source population and several sink populations (a population that cannot maintain itself without migration). In a) movement is unidirectional with smaller sink populations being re-colonized or supplemented from the source population. In b) there is a smaller reciprocal movement or exchange of individuals from the sink populations to the source population.

Wild populations of animals and plants rarely occupy all areas of their range but often occur in discrete populations interacting through migration. An example of a source-sink metapopulation can be envisioned in the wildebeest (*Connochaetes taurinus mearnsi*) population in the Serengeti-Mara ecosystem in Kenya and Tanzania. In this system the majority of the million plus wildebeest participate in the annual migration throughout their range. However, at the extremes of the migration route in the Masai-Mara National Reserve, Ngorongoro Conservation Area, and the western Grumeti River corridor of the Serengeti National Park there are smaller resident populations. It has been estimated that there is up to around a 10% exchange of individuals between the smaller resident populations and the large migratory herds (Estes 1969) (Figure 4). Prior to the reduction in populations of addax and scimitar-horned oryx, due to habitat loss, over-hunting, and competition with humans and their livestock, it is conceivable that migration would have maintained connections between the various populations.

Figure 4. Generalized representation illustrating the migration route (arrows) of wildebeest in the Serengeti-Mara ecosystem and the location of resident populations (circles) that interact with the migratory herds.

In today's conservation world national parks, game reserves, and other protected areas have become subpopulations within larger pre-existing metapopulations. However, the rates of migration and even the ability to migrate have become hampered by intervening human populations or other physical barriers, such as fences. Addax and scimitar-horned oryx have been sent to release projects in national parks and reserves in several former range countries in the Sahelo-Saharan region, e.g., Tunisia: Bou Hedma 1985 and Sidi Toui 1999, Morocco: Souss Massa 1995; Senegal: Ferlo 1988. The majority of these areas are completely fenced from surrounding areas. However, fences around these protected areas are not necessarily sufficient in themselves to ensure the conservation in the long-term for these endangered species without active management. These populations are still susceptible to extinction through demographic stochasticity, whereby the size of the breeding population is affected by random or chance variation in sex ratios, and survival and reproductive rates among males and females in a population. In addition, reproduction in these types of population can be influenced by environmental changes such a drought and disease. Eventually, these closed populations may suffer a loss of genetic diversity through genetic drift, i.e., a random loss of genetic variability due to variation in population size and reproductive rates, and inbreeding, i.e., mating between related individuals (Hedrick 2005).

Why Conserve Genetic Variability?

The genetic health of a population, i.e. its ability to adapt to present or future environmental conditions, rests upon the maintenance of genetic diversity within it (Hedrick 2005). The level of genetic variation determines the potential of a population to adapt to changes in environmental conditions. Populations with low genetic variation are expected to have lower adaptive potentials to cope with environmental changes than populations with high levels of genetic variation. The environment not only changes over time due to for example climatic changes but also fluctuates annually, seasonally and even daily. Therefore genetic variation in a population is important to adapt or be adapted to both short term and long term changes in the environment.

In addition, a loss of genetic diversity can have negative effects on the ability of a population to exist through even short periods of time by increasing the effects of inbreeding in a population, and decreasing the populations ability to adapt to different selection pressures, e.g., changing climatic conditions or food supplies, or the addition of new predators, parasites, competitors, or diseases. The negative effects of inbreeding include higher mortality, reduced competitive ability, greater susceptibility to disease, lower fecundity, and more frequent developmental defects.

Regional captive breeding programs for addax and scimitar-horned oryx, such as the Species Survival Plan (SSP) in North America and the European Endangered Species Program (EEP) are managed to maintain as much of the original genetic variability brought into captivity as possible. Each of the founders of the captive population (wild caught animals that left living descendants in the captive population) should be represented in the restored population. In principle, animals selected for release projects should be descended from founders that are already well represented in the captive gene pool. Although significant resources have been put into the restoration of the species in their historic range at present the animals established in *in situ* protected areas (national parks) represent only a fraction of the genetic variability available in the captive population.

Since these subpopulations are small and isolated without any possibility of natural gene flow among them and to minimize genetic and demographic problems associated with small isolated

populations, the only chance for the species' long-term survival is with the implementation of a management program that treats them as one large metapopulation. One requirement of metapopulation management is that subpopulations must be mixed genetically by moving animals among the subpopulations.

The initial proposed plan for oryx and addax within Tunisia would be to manage the oryx in Bou Hedma, Dghoumes, and Sidi Toui with occasional supplementation from the EEP and SSP as one metapopulation. The addax would be managed between Djebil, Senghar, and Oued Dekouk with occasional supplementation from the EEP and SSP as a second metapopulation (Figure 5).

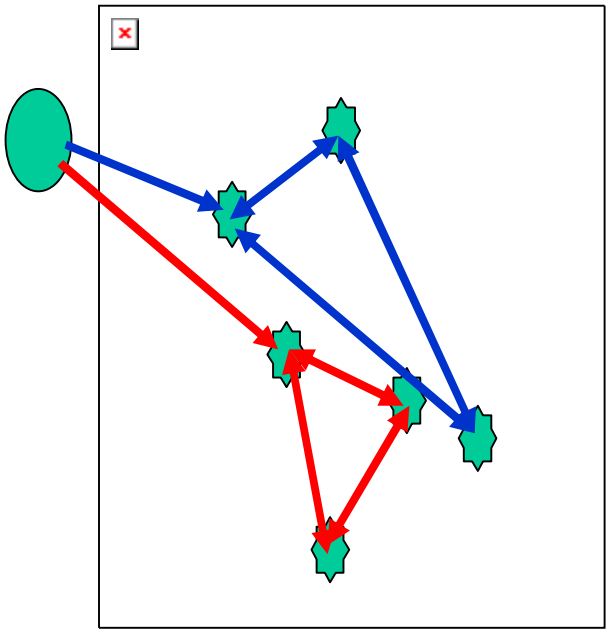


Figure 5. Relationships of the proposed metapopulations for oryx (blue) in the north and addax (red) in the south of Tunisia.

Modeling and Population Viability Analysis

In the last few years metapopulation concepts and models have been used to examine specific problems in conservation (Yuttham et al. 2003). They have contributed significantly into insights on conservation and have stimulated research into field studies focusing on the collection of demographic data and movements of individuals in wild and free-ranging populations. Metapopulation concepts have also become prominent in examining correlations between behavioral and ecological variables and probabilities of population persistence or extinction (Yuttham et al. 2003). This in turn has lead to the development of management models and testing the effects of various management decisions (Akçakaya and Sjögren-Gulve 2000; Reed et al. 2002; Tenhumberg et al. 2004).

In order to create a metapopulation management plan knowledge of the existing population(s) is essential. Information on population growth, age at first reproduction, mortality rates, reproductive strategies of males and females, etc. is important in order to model the effects of various management plans, e.g., supplementation and translocation, on the populations.

Models are commonly used in a process called Population Viability Analysis (PVA) (Lacy 1993; Akçakaya and Sjögren-Gulve 2000, Morris et al 2002; Reed et al. 2002). PVA is a commonly used tool in endangered species management. It can be defined as "a collection of methods for evaluating the threats faced by populations of species, their risks of extinction or decline, and their chances for recovery, based on species-specific data and models" (Akçakaya and Sjögren-Gulve 2000). PVA's are often single species models and based on data that may or may not be available (Akçakaya and Sjögren-Gulve 2000; Reed et al. 2002). For species where the relevant data to build the model may not be available data from other populations or species along with certain assumptions may have to be made. A commonly used software program for PVA is VORTEX (http://www.vortex9.org/vortex.html) (Lacy 1993, Lacy et al. 2005, Miller and Lacy 2005).

VORTEX is an individual-based simulation model for population viability analysis. VORTEX simulates a population passing through a series of events that define a typical life cycle of a sexually reproducing, diploid organism (Miller and Lacy 2005). In order to develop a model for population management using VORTEX various data and assumptions are required. Input parameters required include: age at first reproduction for males and females, maximum age of reproduction, inbreeding depression, percent of males and females in the breeding pool, mortality rates, evidence and incidence of catastrophes, and carrying capacity.

From the Scimitar-horned Oryx International Studbook (Tania Gilbert pers. comm.) data on zoo populations shows that female oryx on average have their first calf at 2 years of age. For males, based on known reproduction in the related addax, it is assumed that they could breed as early as 10 months of age (Spevak unpubl.). However, the average age at first reproduction is around two years of age for males. In a wild or free-ranging population there would most likely be increased competition between males and increased female choice. This would have the effect of delaying the average age of reproduction until the 3rd year age class or later (Spevak unpubl.). Therefore, both 2 years and 3 years for age of first reproduction of males were modeled. Additionally, due to competition not every male would probably have access to breeding females. There are several known herds with herd males in Bou Hedma and additional solitary males that may have access to females when the female herds move through their territories. From census data this would account for 15% of the males. Subordinate males moving with the herds may also have access to females which along with the solitary and dominant males is estimated to make up about 50% of the male population. Both 15% and 50% were modeled.

There is little demographic data for scimitar-horned oryx in the wild. Mortality data was extracted from mortality data within the EEP and SSP programs. This may be a more optimistic projection for mortality values in the wild but does serve as a starting point.

Known relations of the original 10 founders of the Bou Hedma reintroduction are known from studbook data (Tania Gilbert pers. comm.) Ever since Ralls et al. (1979) examined captive populations of oryx it has been know that oryx as well as other species of ungulates are sensitive to inbreeding depression effecting fecundity and survival. For both of these reason therefore, this was also included in the model.

In order to model potential catastrophes calculations of growth rates were made from census data of oryx in Bou Hedma (Figure 6). Lambda (λ) is defined as the geometric growth rate of a population and represents the population growth rate from one year to the next (Ricklefs 1979). The geometric growth rate is not necessarily a constant and from census data for oryx in Bou Hedma lambda ranged from 0.9 to 1.27 per year with an average across years of 1.11 (Figure

7). Changes in population growth rate can be affected by a variety factors from predation to disease to inbreeding depression to environmental variables. Since there was little data on predation and disease and none on inbreeding a first examination looked at environmental factors such as rainfall. Since rainfall amounts are correlated with plant productivity and base nutrition levels it is hypothesized that population growth rate would be affected by rainfall and drought. Rainfall data was available for Bou Hedma for the years 1996 through 2004. Plotting this data against lambda (Figure 8) appears to show a change in growth rate with rainfall with a decline in growth rate the year after rainfall declines or an increase in growth rate when rainfall is higher than the previous season. This information along with an examination of rainfall patterns in Tunisia indicating an approximate 7 year cycle for droughts and good rains was used to model two catastrophes in the simulation at a frequency of 15% each. When the model simulated a drought a 20% decline in reproduction and survival occurred. When heavier than normal rains occur a 15% increase in reproduction and 100% survival occurred. Table 1 summarizes the modeling parameters and Appendix 1 gives the input values for the model.

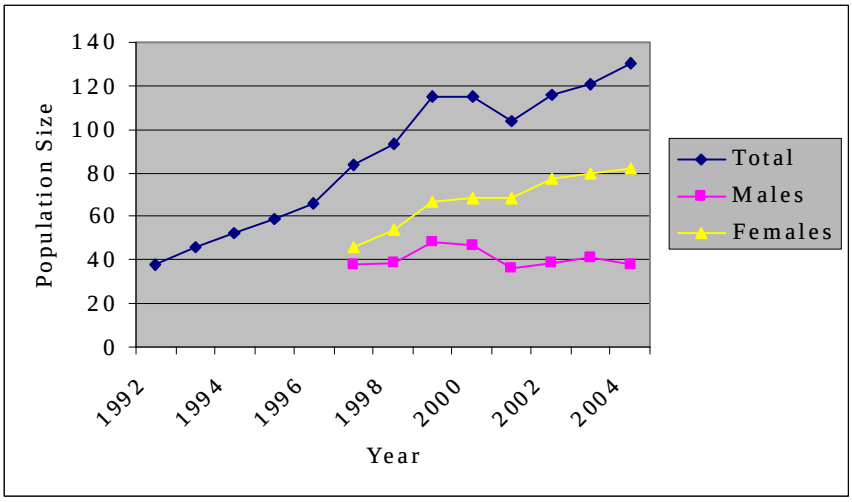


Figure 6. Scimitar-horned oryx population census for Bou Hedma National Park.

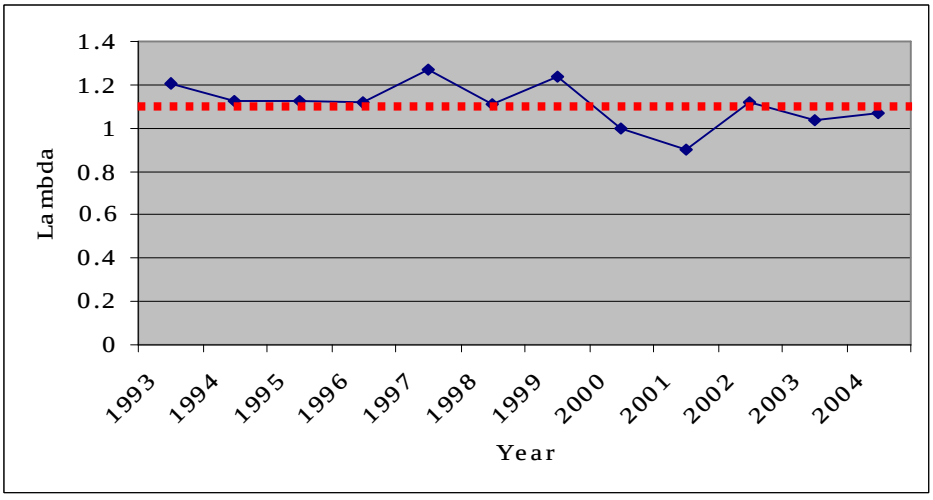


Figure 7. Geometric growth rates, i.e. population growth from year to year calculated from census data for Bou Hedma oryx. Dotted line indicates mean geometric growth rate across years.

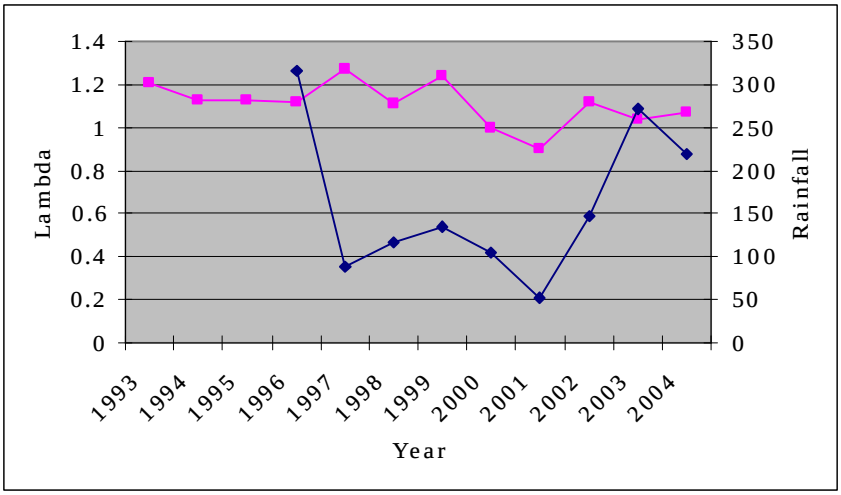


Figure 8. Geometric growth rate of oryx plotted against annual rainfall data for Bou Hedma.

Table 1. Summary of Modeling Parameters (See Appendix 1 for input values)

- Program: Vortex 9.51
- Age at first reproduction: 2 years females, 2 or 3 years males
- Maximum age of reproduction: 10 or 12 years
- Inbreeding depression: included
- Environmental variation: concordant between reproduction and mortality
- Sex Ratio at Birth: 50:50
- % of Males in Breeding Pool: 15 or 50%
- % of adult females breeding: 100% at low density, 50% at high density
- Mating system: Polygynous
- Initial population size: 10 (5.5) from studbook data
- Mortality estimates: Estimated from Captive Populations
- Catastrophes: Drought and Rain, frequency 15% or approximately once every 7 years. Drought effect on reproduction and survival 80%, rain effect of reproduction 115% and survival 100%
- Carrying capacity: 130 with an environmental variation of +/- 20

Results

The purpose of this first modeling attempt was to verify the input parameters for this population of oryx. Were the biological assumptions for reproduction and mortality realistic? Did the population persist? Did the simulation indicate additional areas of study? And are there some assumptions on the behavior and ecology of the oryx that can be discarded?

Eight different simulations were run for 100 iterations on the modeled oryx population. The variables that were changed between scenarios was male age at first reproduction (2 or 3 years of age), maximum age of reproduction both sexes (10 or 12 years), and percent of males breeding (15% or 50%). All other variables were kept constant for these trials. The eight scenarios were:

1) Males breed at 2 years of age, max age repro 12 years, 50% of males in breeding pool
2) Males breed at 2 years of age, max age repro 10 years, 50% of males in breeding pool
3) Males breed at 2 years of age, max age repro 12 years, 15% of males in breeding pool
4) Males breed at 2 years of age, max age repro 10 years, 15% of males in breeding pool
5) Males breed at 3 years of age, max age repro 12 years, 50% of males in breeding pool
6) Males breed at 3 years of age, max age repro 10 years, 50% of males in breeding pool
7) Males breed at 3 years of age, max age repro 12 years, 15% of males in breeding pool
8) Males breed at 3 years of age, max age repro 10 years, 15% of males in breeding pool

Across all simulations Scenarios 2, 3, and 4 had population declines with the highest probabilities of extinction and the greatest loss of gene diversity (Figures 9, 10, and 11). All three scenarios had males breeding early, though the percent of males breeding and age of breeding senescence varied. This would tend to indicate that males actually breed later due to competition, territoriality, and dominance as has been seen in related addax (Spevak unpubl.) The one population where males bred early and did not go extinct had a higher proportion of males breeding as well as a later maximum age of reproduction. Why this would be the case needs to be examined. Table 2 summarizes the scenarios and the results for mean extinction probability, mean population size, and mean gene diversity across iterations.

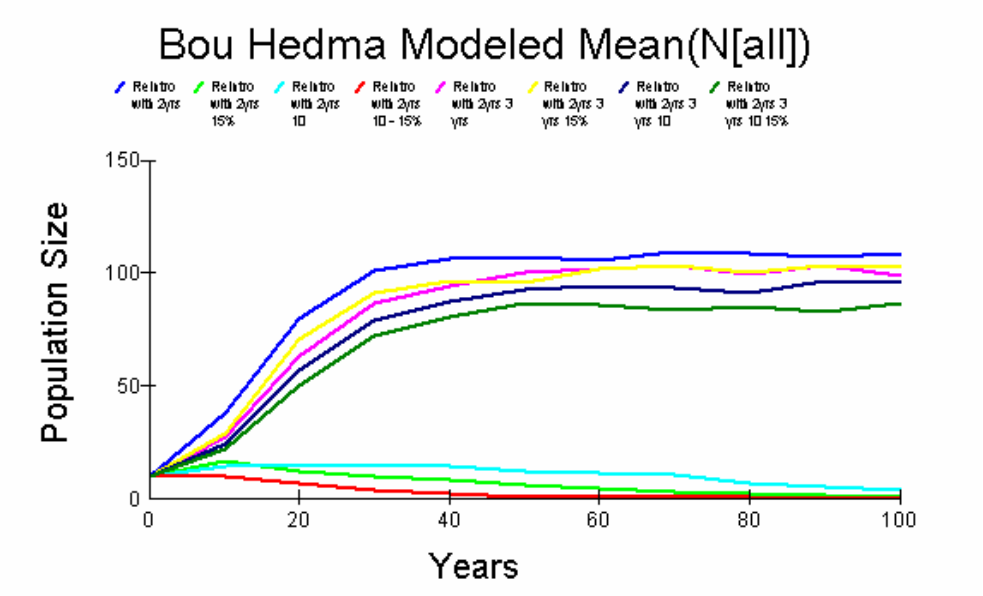


Figure 9. Mean population sizes of eight modeled scenario of the scimitar-horned oryx population in Bou Hedma as modeled in VORTEX. Three populations went extinct or approached extinction.

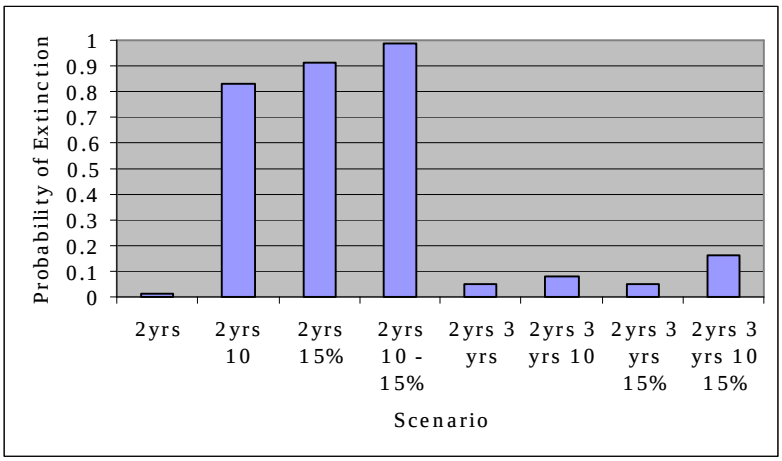


Figure 10. Mean probabilities of extinction for eight modeled scenarios of the scimitar-horned oryx population in Bou Hedma as modeled in VORTEX.

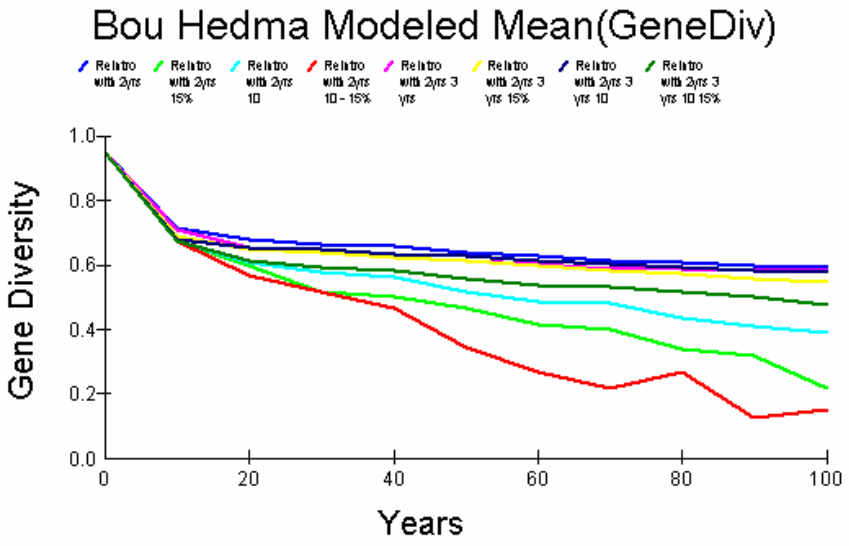


Figure 11. Mean Gene Diversity of eight modeled scenario of the scimitar-horned oryx population in Bou Hedma as modeled in VORTEX.

Table 2. Summary of VORTEX simulations for eight scenarios of scimitar-horned oryx in Bou Hedma National Park

Scenario	Probability of Extinction	Mean Final Population Size (SD)	Final Expected Gene Diversity (SD)
1) Males breed at 2 years of age, max age repro 12 years, 50% of males in breeding pool	0.01	108.59(17.75)	0.5911(0.1662)
2) Males breed at 2 years of age, max age repro 10 years, 50% of males in breeding pool	0.83	3.6(11.08)	0.3897(0.2467)
3) Males breed at 2 years of age, max age repro 12 years, 15% of males in breeding pool	0.91	0.78(2.48)	0.2196(0.2356)
4) Males breed at 2 years of age, max age repro 10 years, 15% of males in breeding pool	0.99	0.06(0.6)	0.1528(0)
5) Males breed at 3 years of age, max age repro 12 years, 50% of males in breeding pool	0.05	99.14(27.64)	0.5811(0.1547)
6) Males breed at 3 years of age, max age repro 10 years, 50% of males in breeding pool	0.08	95.8(32.91)	0.5758(0.1495)
7) Males breed at 3 years of age, max age repro 12 years, 15% of males in breeding pool	0.05	102.62(29.08)	0.5458(0.1673)
8) Males breed at 3 years of age, max age repro 10 years, 15% of males in breeding pool	0.16	86.45(40.67)	0.4784(0.1951)

This preliminary step in metapopulation modeling and population viability analysis appears to conform to the existing oryx population in Bou Hedma. However, as with other PVA analyses it has led to questions needing additional research (Morris et al. 2002). Are males breeding at 2 years of age or are older male monopolizing females, i.e., what is male reproductive success? How do mortality rates in a captive situation compare with the wild or semi-free ranging population, higher or lower? Is there density dependent mortality and reproduction? Additional sensitivity tests of the model also need to be performed to determine what parameters most effect population persistence.

What are the next steps in refining the model for antelope populations in Tunisian National Parks? First off, as stated most of these steps will require additional research on the behavior, ecology, and demographics of existing oryx populations. Secondly, an estimation of sustainable carrying capacities should be established as this will help in determining the number of animals that can be translocated between parks without compromising existing populations. Of course additional parks need to be incorporated into the model and various management strategies need to be modeled, e.g., translocation and harvesting. But most importantly more people need to be involved in the process from the decision makers to the staff on the ground in order to show the value of modeling as a conservation tool. And finally do it all over again for Addax.

References:

Akçakaya, H.R. and P. Sjögren-Gulve. 2000. Population viability analysis in conservation planning: an overview. **Ecol. Bull**. 48:9-21

Estes, R.D. 1969. Territorial behavior of the wildebeest (*Connochaetes taurinus* Burchell, 1823) **Z. Tierpschol**. 26:284-370

Hedrick, Philip W. 2005. **Genetics of Populations**. Third Edition. Jones and Bartlett Publishers. Sudbury, Massachusetts

Lacy, Robert C. 1993. VORTEX: a computer simulation model for population viability analysis. **Wildl. Res**. 20: 45-65

Lacy, R.C., M. Borbat and J.P. Pollack. 2005. **VORTEX: A Stochastic Simulation of the Extinction Process**. Version 9.50. Brookfield, IL. Chicago Zoological Society

Levins, R. 1969. Some demographic and genetic consequences of environmental heterogeneity for biological control. **Bull. Entomol. Soc. Am**. 15:237-240

McCarthy, M.A., H.P. Possingham, J.R. Day, and A.J. Tyre. 2001. Testing the accuracy of population viability analysis. **Conserv. Bio**. 15(4): 1030-1038

Miller, P. S. and R. C. Lacy, R.C. 2005. **VORTEX: A Stochastic Simulation of the Extinction Process. Version 9.50 Users Manual**. Apple Valley, MN. Conservation Breeding Specialist Group.

Morris, William F., Philip L. Bloch, Brian R, Hudgens, Leonie C. Moyle, and John R. Stinchcombe. 2002. Population viability analysis in endangered species recovery plans: past use and future improvements. **Ecol. Appl**. 12(3): 708-712

Ralls, K., K. Brugger and J. Ballou. 1979. Inbreeding and juvenile mortality in small populations of ungulates. Science. 206: 1101-1103.

Reed, J. Michael, L. Scott Mills, John B. Dunning Jr., Eric S. Menges, Kevin S. McKelvey, Robert Frye, Steven R. Beissinger, Marie-Charlotte Anstett, and Philip Miller. 2002. Emerging issues in population viability analysis. Conserv. Bio. 16 (1) 7-19

Ricklefs, Robert E, 1979. **Ecology** (second edition). Chiron Press Inc. New York

Tenhumberg, Brigitte, Andrew J. Tyre, Katriona Shea, and Hugh P. Possingham. 2004. Linking wild and captive populations to maximize species persistence: optimal translocation strategies. **Conserv. Bio**. 18(5): 1304-1314

Yuttham, Kopson, Mullica Jaroensutasinee, and Krisanadej Jarouensutasinee. 2003. Metapopulation and its application in conservation biology. **Songklanakarin J. Sci. Technol**. 25 (3) 395-409

Appendix 1: VORTEX (version 9.51) input parameters, Scimitar-horned oryx in Bou Hedma National Park

Parameter	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8
Iterations	100	100	100	100	100	100	100	100
Years	100	100	100	100	100	100	100	100
Extinction	1 sex	1 sex	1 sex	1 sex	1 sex	1 sex	1 sex	1 sex
Number of Populations	1	1	1	1	1	1	1	1
In-breeding Depression	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EV Concordance Reproduction & Survival	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Catastrophe 1	Drought	Drought	Drought	Drought	Drought	Drought	Drought	Drought
Frequency	15%	15%	15%	15%	15%	15%	15%	15%
Severity of reproduction	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Severity on survival	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Catastrophe	Rain	Rain	Rain	Rain	Rain	Rain	Rain	Rain
Frequency	15%	15%	15%	15%	15%	15%	15%	15%
Severity of reproduction	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Severity on survival	0	0	0	0	0	0	0	0
Mating System	Polygynous	Polygynous	Polygynous	Polygynous	Polygynous	Polygynous	Polygynous	Polygynous
Age of first offspring females	2	2	2	2	2	2	2	2
Age of first offspring males	2	2	2	2	3	3	3	3
Max age reproduction	12	10	12	10	12	10	12	10
Max progeny per year	1	1	1	1	1	1	1	1
Sex ratio at birth	50%	50%	50%	50%	50%	50%	50%	50%
Density dependence on reproduction	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
%adult females breeding	(100-((100-50)*((N/K)^16)))*(N/(0+N))	(100-((100-50)*((N/K)^16)))*(N/(0+N))	(100-((100-50)*((N/K)^16)))*(N/(0+N))	(100-((100-50)*((N/K)^16)))*(N/(0+N))	(100-((100-50)*((N/K)^16)))*(N/(0+N))	(100-((100-50)*((N/K)^16)))*(N/(0+N))	(100-((100-50)*((N/K)^16)))*(N/(0+N))	(100-((100-50)*((N/K)^16)))*(N/(0+N))
EV % breeding	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
% females have 1 offspring	100	100	100	100	100	100	100	100
% female 0-1 mortality	26	26	26	26	26	26	26	26
EV in % mortality	3	3	3	3	3	3	3	3
% female 1-2 mortality	5	5	5	5	5	5	5	5
EV in % mortality	1	1	1	1	1	1	1	1
% female >2 mortality	3	3	3	3	3	3	3	3
% male 0-1 mortality	32	32	32	32	32	32	32	32
EV in % mortality	5	5	5	5	5	5	5	5
% male 1-2 mortality	12	12	12	12	12	12	12	12
EV in % mortality	4	4	4	4	4	4	4	4
% male >2 mortality	8	8	8	8	8	8	8	8
EV in % mortality	1	1	1	1	1	1	1	1
% males in breeding pool	50	50	15	15	50	50	15	15
Initial population size	10	10	10	10	10	10	10	10
Carrying Capacity	130	130	130	130	130	130	130	130
EV in Carrying Capacity	20	20	20	20	20	20	20	20

Dama gazelles in the South-Tamesna, Mali? Yes, There Are! A total Count of the Dorcas Gazelles on Tidra Island, Banc d'Arguin Park National, Mauritania
François Lamarque

This paper presents the results of a field mission carried out by ONCFS, DNCN (Malian National Direction of Nature Conservation) and SCAC (French Cooperation and Cultural Action Service) in South Tamesna between 06th and 18th February 2005.

1. FRAMEWORK AND OBJECTIVES

1.1. Background

The presence of dama gazelles (*Gazella dama dama*) which would be an exciting international conservation stake for Mali, was confirmed again in 2003 and 2004. The recent observations regarded 8 to 10 sites located in the zone which had been identified already during the former ONCFS missions in 2000 and 2002 (South Tamesna, communes of Tidarmène, Alata and Télataï belonging to the "*Cercle de Ménaka*" - Gao region). However, no direct observation of dama gazelle could be done during the investigations carried out in the zone by the DNCN local services. Thus, the organization of a systematic survey of the "dama sites", using a reliable methodology, was considered as an absolute priority by the SSA CMS/FFEM project.

Given the former involvement of the *Office national de la chasse et de la faune sauvage* in the SSA conservation problematic in Mali, CMS asked if a study, validated by all the partners of the project and namely the Malian authorities, aiming at determining the status of the dama gazelles, highly endangered species at the international level, in Mali. This operation forms the program 2004-2 of the SSA CMS/FFEM project, was funded by the FFEM project for 10.000 € and receives a support the Saint Louis Zoo, Missouri (USA) which gave a grant of $6,000 in the framework of Saint Louis Zoo's Field Research for Conservation (FRC) programs.

1.2. Objectives

The Terms of Reference fixed by the CMS Letter of Agreement were:

1. Confirm the presence of a (several) viable population(s) of dama gazelles in the Malian Tamesna;
2. Make a first rough estimate of the number of this (these) population(s);
3. Establish a draft cartography of the geographic distribution of the different groups and of the suitable habitats;
4. Train the Malian technicians in survey and monitoring methods adapted to Sahelo-Saharan antelopes;
5. Make proposals for the preservation of the found population(s) of dama gazelle (modifications of the limits for the proposed Tamesna Faunal Reserve - PTFR, e.g.) or further monitoring (terrestrial monitoring by local staff, aerial surveys);
6. Make proposal of new orientations for the SSA CMS/FFEM project activities in Mali;
7. (Eventually, appraise the abundance of dorcas gazelles in the South Tamesna using the Kilometric index [KI] method).

2. METHOD

2.1. Choice of the method

A survey of the "dama zones" following a pre-definite systematic sampling pattern was carried out in the field. It implies that the zones susceptible to shelter dama gazelles be delineated the more exactly possible on 1/200.000 maps, then that routes to follow be drawn on these maps in

order to sample correctly the defined zones. In these zones, data collection aimed at two results simultaneously:

1. Qualitative inventory of the existing species: elaboration of a first presence-absence distribution map using the grid method.
2. Quantitative inventory of the existing species with a special focus on dama gazelle: calculation of a Kilometric index (KI) for the main species (gazelles notably) and, if possible, evaluation of densities or numbers.

2.2. Characteristics of the zones surveyed

Two zones to be surveyed were defined before the mission using the geographic coordinates of the last dama gazelle observations given by the Kidal DRCN, Amewey AG SID'AHMED. These two zones, are located in the "Cercle de Ménaka", Gao region (7th region), about 1,500 km east from Bamako (See map 1 in Appendix 2).

These zones were defined again during the mission following new data on dama observations. They were also dramatically reduced because of the driving difficulties met in the field. Thus, the zones really covered were:

- **Zone 1 "East" or "Inékar":** Rectangle 25 km wide (east-west) and 40 km high (north-south), i.e. an area of 1,000 km². Geographic coordinates of the limits: 03°50 E-16°43' 600 N; 04°03' 500 E-16°43' 600 N; 03°50' E-16°22' N; 04°03' 500 E-16°22' N.
- **Zone 2 "West" or "Ezgueret/Amastaouâs":** Rectangle 30 km wide (east-west) and 24 km high (north-south), i.e. an area of 720 km². Geographic coordinates of the limits: 01°56' E-17°08' N; 02°12' E-17°08' N; 01°56' E-16°54' 800 N; 02°12 E-16°54' 800 N.

2.3. Implementation of the method

2.3.1. Before the departure in the field

The two zones were plotted on IGN 1/200.000 maps. Transects were then drawn on the two zones according to the following pattern:

- Zone 1: 6 transects west-east 25 km long and 8 km apart;
- Zone 2: 4 transects west-east 30 km long and 8 km apart.

The drawn transects were numbered. Their departure and arrival coordinates (WGS 84 format), were entered as *waypoints* in two GPS. These transects were then divided into "sections" 5 km long, to perform a statistical analysis of the distribution of the observed species according to the various descriptive parameters of the habitat collected.

The day before the departure, the method and the way to fill the data collection forms were exposed. Some exercises were used to check the ability of the missionaries to identify the main species susceptible to be met (mammals and birds) and to train them to the use of the variables "habitat" according to the typology defined for North Tamesna in February 2002. Two teams were formed (one per car), each member having his assigned duty.

2.3.2. In the field

Visibility and strip width evaluation

The estimation of the distances by the observers was tested before the beginning of the exercise by posting a person at known distances (250, 350 m, 600 m). This exercise allowed

also to check the visibility. That one was estimated to be at least 600 meters. However, some observations made after at about 800 meters, show that, at least in some places, the visibility was close to one kilometre. The further analyses will nevertheless consider a strip width of 1 km (2 x 500 m on each side of the car). The sampling ratios for this width will be then: 14,6 % for zone 1 and 16 % for zone 2.

Running of the transects

In each zone, the cars connected by a VHF radio liaison, went to the departure point of transect 1 (or the closest to this point given the access difficulties) using geographic coordinates entered in the GPS. The transect was then run to its arrival point by the two cars (possibly circulating one behind the other about 300 meters apart), to the best of and the closest to its theoretical route entered in the GPS, adapting it to the field difficulties.

The same procedure was followed for transect 2 which was begun by its extremity closest to the end of transect 1 to avoid useless movements. So were run the following transects.

The front car's navigators watched over the respect of the routes. The secretary of this same car was in charge of picking out the hour and the geographic coordinates of the true departure (and arrival if necessary) points of the transects and sections. He recorded then these data on the form "Observations". In the field, the length of the sections (5 km) were measured by using the car odometer and/or the GPS.

Recording of the observations

All the observations of wildlife (species, group size, geographic coordinates) were recorded whenever they occurred on the form "Observations" (Appendix 4).
For gazelles were also recorded:

- the distance to which the individuals were seen for the first time;
- the behaviour when detected: fleeing or immobile. At the end of each 5 km section, a description of the main habitat was reported on the form "Habitat" (Appendix 3), filling the following imprints coming from the typology which had been defined in February 2002;
- soil nature: sand/sand and clay, reg, sand and gravels;
- relief: flat, undulating, presence of dunes;
- herbaceous vegetation: absence, scarce or "steppe", "patches";
- trees: absence, "isolated trees", "thickets";
- signs of human activities: people, camp, well, car tracks (truck possibly), dromedaries, cattle, sheep and goats, donkeys.

The signs of dama gazelle's presence (spoors, droppings, horn) were recorded and geo-referenced. Samples of pellets were collected, geo-referenced and immediately stocked in 60° ethanol for their further genetic analysis by the Molecular Genetics Laboratory of King Khalid Wildlife Research Centre in Riyadh, Saudi Arabia, (KKWRC).

At last, all the data on the last reliable observations of dama gazelles were recorded beside local informers.

2.4. Data processing

2.4.1. Qualitative inventory of the existing species

All the direct observations of the species as well as the signs of presence of dama gazelle which could have been recorded were reported on a geo-referenced map of each of the two zones.

Presence-absence distribution maps for the main observed species were established using a grid with pre-definite meshes 5 km wide (east-west) x 8 km high (north-south).

2.4.2. Zones' description

The descriptors "Habitat", collected every 5 km at the end of the sections, were used to describe the zones and make a summary cartography with the same method and the same grid as for wildlife observations. A first preliminary characterization of the habitat most suitable for dama gazelles was drawn from these rough maps.

2.4.3. Analysis of the species distribution

The habitat descriptors were also submitted to a Multiple Correspondence Analysis (MCA).

A tentative of prediction of the dama gazelle presence/absence in the sections according to the habitat descriptors and to factors coming from MCA in zones 1 and 2 was then tried. For that, three methods were tested: classical Discriminant Factorial Analysis (DFA), logistic regression and Partial Least Squares Discriminant Analysis (PLS-DA).

2.4.4. Quantitative inventory of the existing species

KI and other indexes

The following indexes were calculated for the dama and dorcas gazelles: % of sections without observation, Mean number of groups per section, Mean size of the groups and Kilometric Index (KI).

The percentage of sections without the considered species and the mean number of groups of this species per section will give information on its repartition, the mean size of the groups on its structure and the Kilometric index on its abundance.

Calculation of the numbers and/or the densities

An assessment of the numbers of dama and dorcas gazelles in the two zones surveyed was considered using two approaches: the *design-based* mode and the *model-based* mode. For the calculations, the spoors were taken into account. It was assumed that, unless contradictory information noted on the form "Observations", one spoor represented one individual. This postulate will lead likely to an underestimation since, several times, the spoors recorded on the form had been clearly made by several animals.

2.4.5. Genetic analyses

First, the faecal pellets were air-dried and then rinsed with sterile, distilled water to remove any sloughed intestinal epithelial cells from the surfaces. Second, the ethanol in which the samples were stored was centrifuged at high speed (14.000 tr/mn) to extract any organic matter that it might contain. The pelleted material and the water rinse were each processed separately. Polymerase chain reaction (PCR) was performed using protocols and conserved primers optimized in KKWRC laboratory for use with gazelles material which amplify the entire cytochrome-*b* gene. When enough DNA was amplified, the gene was sequenced with an automated sequencer. The nucleotide sequence so obtained was compared with known sequences. The analyzed samples were then situated in a phylogenetic tree.

3. RESULTS

3.1. Qualitative inventory of the existing species

3.1.1. Mammals

The species observed and their number are summarized in Table 1:

Table 1: Mammals observed in the zones surveyed

	Zone 1		Zone 2	
Species	On the transects	Between the transects	On the transects	Between the transects
Gazella dama	7	0	0	0
Gazella dorcas	10	0	20	0
Fennecus zerda	2	0	0	0
Lepus capensis	0	1	2	0
Hyena hyena	0	0	0	1

The recorded signs of presence of dama gazelle (spoors and droppings) and of other species are shown in Table 2.

Table 2: Signs of presence noted in the zones surveyed

	Zone 1		Zone 2	
Species	On the transects	Between the transects	On the transects	Between the transects
Gazella dama	> 12	3 (2 adults, 1 young)	> 7 (of which 1 young)	0
Hystrix cristata	> 1*	0	0	0

* On occupied burrow

Several dorcas gazelles and one African Wild Cat (*Felis sylvestris* group *libyca*) were observed on our way between zone 1 and zone 2.

3.1.2. Birds

Only the two species of Bustard existing in the zone were systematically counted during the running of the transect. Were so counted:

- in zone 1: 39 White-Bellied Bustards (*Eupodotis senegalensis*) and 3 Arabian Bustards (*Ardeotis arabs*);
- in zone 2: 1 Arabian Bustard and 1 White-Bellied Bustard. 2 White-Bellied Bustards were also observed out of transect in this zone.

A few other birds species were also observed in the two zones surveyed and on the way between them. The presence of the following species in South Tamesna is thus confirmed (non exhaustive list): Rüppel's Griffon Vulture (*Gyps rueppelli*), Egyptian Vulture (*Neophron percnopterus*), Pied Crow (*Corvus albus*), Brown-Necked Raven (*Corvus ruficollis*), Helmeted Guineafowl (*Numida meleagris*), Common Quail (*Coturnix coturnix*), Chestnut-Bellied Sandgrouse (*Pterocles exustus*), Dove (*Streptopelia sp.),* probably African Mourning Dove (*S.*

decipiens), Cream-Colored Courser (*Cursorius cursor*), Hoopoe (*Upupa epops*), Southern Grey Schrike (*Lanius meridionalis*), Fulvous Babbler (*Turdoides fulvus*), Nightjar (*Caprimulgus sp.*), possibly Long-Tailed Nightjar (*C. climacurus*), White Wagtail (*Motacilla alba*), Little Weaver (*Ploceus luteolus*), Northern Anteater Chat (*Myrmecocichla aethiops*), Desert Wheatear (*Oenanthe deserti*), Isabelline Wheatear (*Oenanthe isabellina*), Northern Wheatear (*Oenanthe oenanthe*).

3.1.3. Distribution of the species

Presence-absence maps were established with the grid method for the two species of Gazelles (including the signs of presence for dama). These maps are presented on figures 1 and 2.

Figure 1: Presence/absence maps for dama gazelle

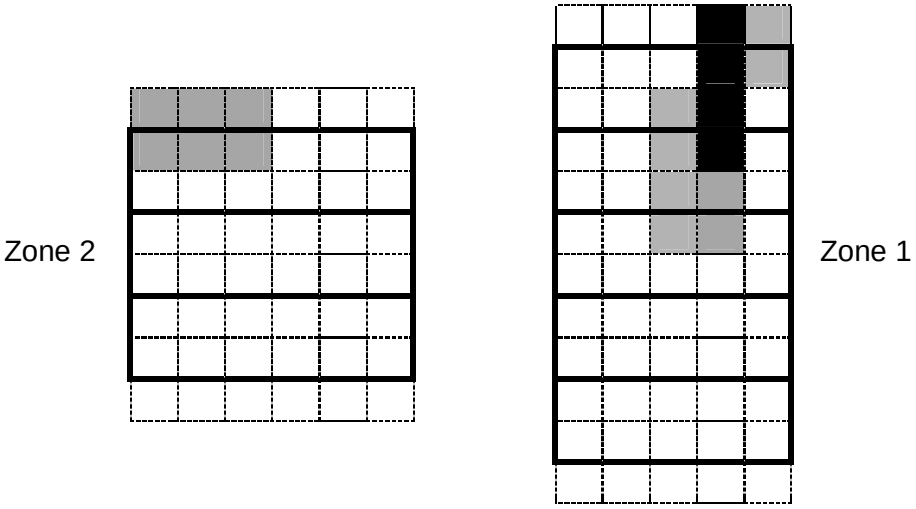
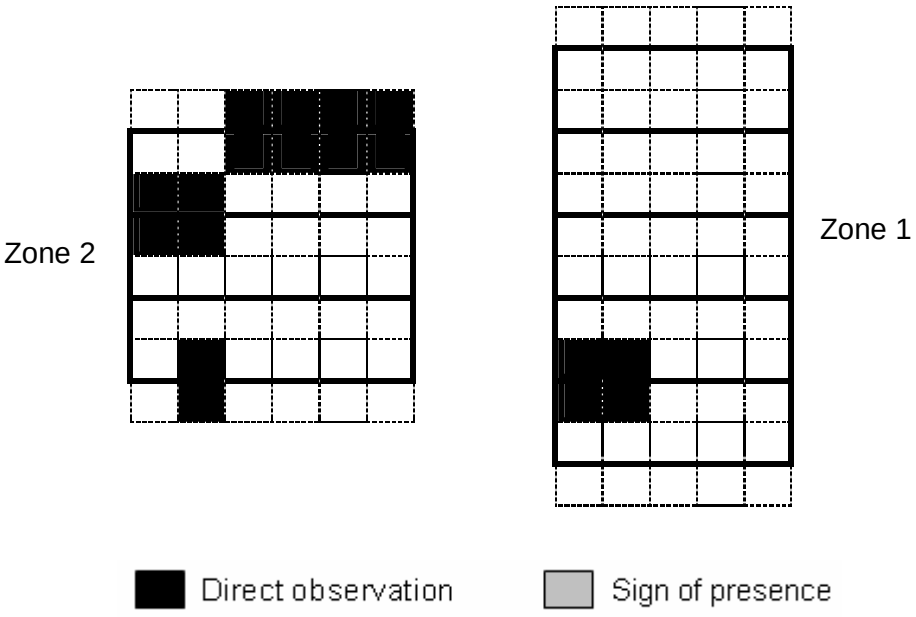


Figure 2: Presence/absence maps for dorcas gazelle



Two general remarks can be drawn from these maps:

- Ø Wildlife seems mainly present in the east of zone 1 and the north of zone 2;
- Ø Dorcas and dama gazelles don't seem to share the same habitat. This is particularly verified in zone 1 where dorcas gazelles were observed in the south-west when the dama and their presence signs were only met in the north-east. It is less true in zone 2 where both the species (or their spoors) are met in the north ; nevertheless, the signs of dama gazelles' presence are only recorded in the north-west when the dorcas are principally observed in the north-east and, to a lesser extent, in the south-west.

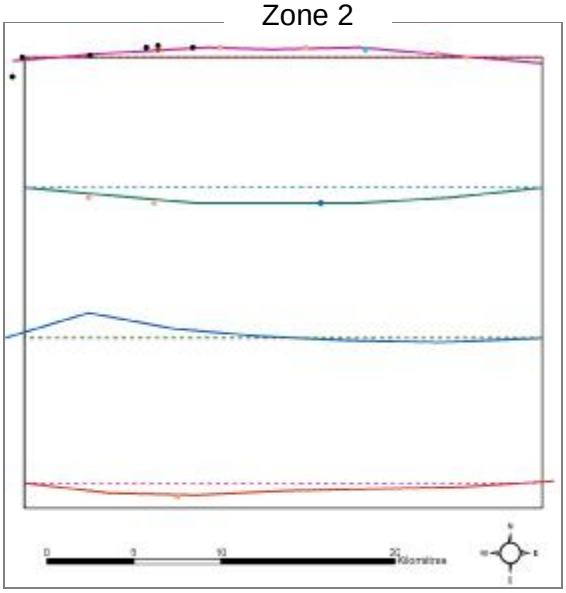
The accurate localization of the direct and indirect observations geo-referenced in the two zones (Figure 3) confirms that they are all concentrated in a very tiny area.

Figure 3 : Localization of the observations in the zones surveyed

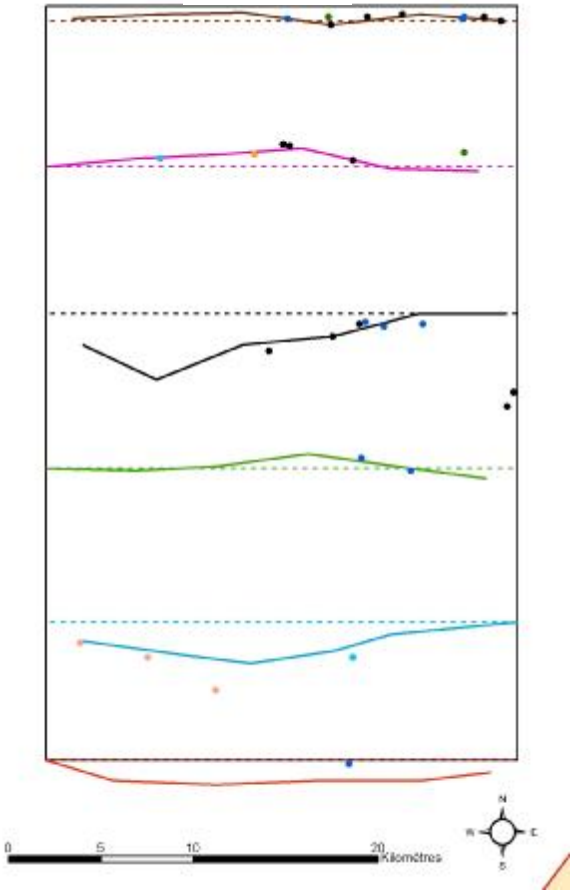
Legend

Ÿ Dama Gazelle
Ÿ Dama Gazelle's spoors
Ÿ Dorcas Gazelle
Ÿ White-Bellied Bustard
Ÿ Arabian Bustard
Ÿ Fennec Fox
Ÿ Cape Hare
- - - Theoretical transect
Transect run

Zone 2



Zone 1



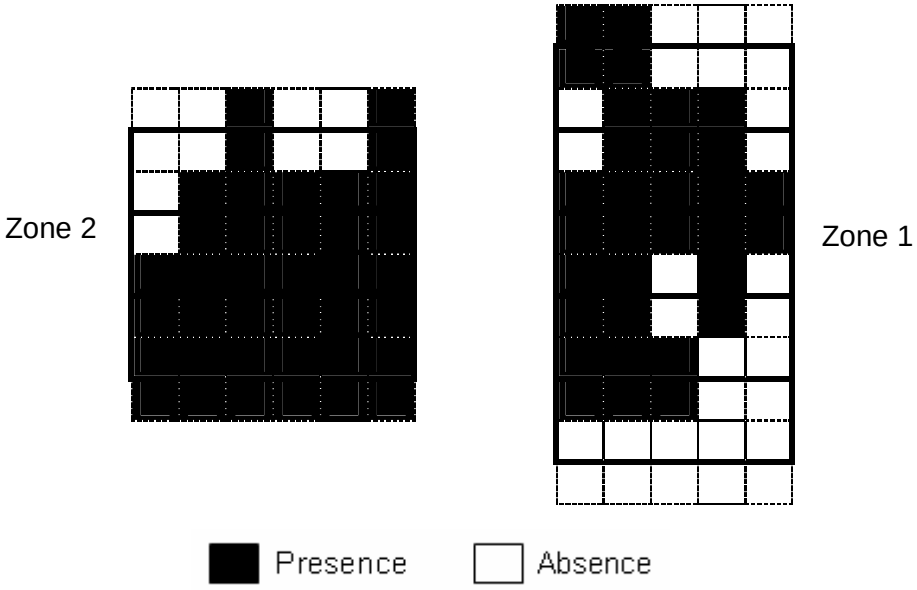
3.2. Approach of the most suitable habitat for dama gazelles

A rough analysis, without any statistical value[1], of the habitat descriptors of the sections on which were seen dama gazelles or their signs of presence, allows to establish a first description of what seems to be the most suitable habitat for this species in the two zones surveyed. This habitat would be thus characterized by:

- Ø a relief rather uneven with important undulation;
- Ø a soil sandy or sandy-clayish;
- Ø grasses forming patches and/or tufts with presence of "wild pumpkins";
- Ø scattered trees, with notably Acacias (obvious signs of browsing were recorded on *Acacia ehrenbergiana* in zone 1);
- Ø no pastoral activities (the presence of "wild" dromedaries being considered without impact).

Looking at our data, the impact of hunting, revealed here by car tracks, is not obvious since these tracks were noted on 5 out of 9 sections on which direct or indirect observations of dama gazelles were done, included on one where a visual contact was established (See figure 4). Nevertheless, the real incidence if this activity could be masked by the size of the meshes used for the analysis.

Figure 4: Presence/absence maps of car tracks in the zones surveyed



These results confirm the impression that followed the end of the mission. Actually after having practicing the field, our intimate conviction is that wildlife in general and dama gazelles in particular, takes refuge in places where it is extremely difficult to drive because of an important relief and of the presence of *Panicum turgidum* tufts forming hillocks very difficult to pass. The criterion "inaccessibility" is, for us, the only determining factor of the distribution of dama gazelles.

[1] Unfortunately, the statistical methods, having given no result, it was impossible to make a model for the presence/absence of dama gazelles in accordance with the various habitat descriptors collected in the field.

3.4. Quantitative inventory of the existing species with a special focus on dama gazelles

3.4.1. KI and other indexes

Rough results

The indexes were calculated for the two gazelles species are shown in Table 3.

Table 3: Indexes for the evaluation of gazelles populations in the zones surveyed

		Dama Gazelle Zone 1	**Dorcas Gazelle Zone 1**	**Dorcas Gazelle Zone 2**
Data	Total number of sections run	30	30	24
	Total number of groups of the species	2	5	8
	Total number of individuals observed	7	10	20
Indexes	% of sections without observation	93.33 %	93.33 %	70.83 %
	Mean number of groups per section (min. - max.)	0.067 (0-1)	0.17 (0-3)	0.33 (0-2)
	Mean size of the groups (min. - max.)	3.5 (2-5)	2 (1-4)	2.5 (1-5)
	Kilometric Index (KI)	0.047	0.067	0.17

At the moment, these indexes have only a poor interest. They could be really useful only if the same transects were run again and, if possible on a regular basis. They are nevertheless a "zero point", initial diagnosis which could be used for a possible monitoring of the populations of wildlife in these two zones, and, with many precautions, to compare various zones between them.

Comparison with the results of other censuses

We can compare the indexes calculated here with those which were determined in North Tamesna in February 2002 or, at least for the KI, with those of surveys made in other countries, namely in Niger and in Chad, by specialists from SSIG (*Sahelo-Saharan Interest Group*) or scientists from universities. The indexes deducted from the results of these inventories are shown in Tables 4 and 5.

It is difficult to compare the value of these indexes, because, on the one hand, excepted the inventory carried out in Niger by the Museum and, of course, that implemented by ONCFS in North Tamesna, the method used for these surveys was not strictly the same and, on the other hand, the areas covered were much more important.

The following information must however be drawn from these tables:

Dama gazelles

1. In all the zones surveyed, the number of dama gazelles seen is very low;
2. The gazelles observed are concentrated in very tiny areas (Index: percentage of sections without gazelles);
3. The size of the gazelles' groups is small (mean for all the observations: 2.47 - min: 1 - max: 5);
4. KI's are all below 0.05 that confirms the rarity of the species;
5. These results lead to show that zone 1 would be a region of paramount importance for the conservation of dama gazelle. Actually, all the indexes set it at the first rank of the prospected zones, just before the Chadian Manga, which is another priority zone for the species conservation.

N.B.: If we included also the signs of presence recorded (spoors) and assuming that 1 spoor = 1 gazelle, zone 1 would appear even more important since the $KI_{(direct\ observation\ +\ spoors)}$ = 0.16. Zone 2 would be also among the priority zones for the conservation of dama since its KI_{spoors} = 0.05.

Dorcas gazelles

1. Dorcas gazelles are still widely observed in the majority of the surveyed areas. However, the regions of Agadem and of the erg of Bilma in Niger as well as the two zones in South Tamesna seem to be less "rich" in dorcas;

2. Given all the results exposed above, zones 1 and 2 in South Tamesna seem to be much less important than North Tamesna for the conservation of dorcas gazelles both at the Malian national level and at the international level. Actually, if North Tamesna is at the 5^{th} rank for KI among all the prospected zones, the two zones of South Tamesna are only at the 10^{th} and the 11^{th} position.

Table 4: Compared indexes for the evaluation of dama gazelles' populations in several regions of central Sahel

		MALI	**NIGER**			**CHAD**	
		Zone 1 2005	Termit MNHN 2002	Termit SSIG 2002	RNNAT SSIG 2002	Manga SSIG 2001	Centre SSIG 2001
Data	Total number of sections run	30	343	51	147	78.4	132.5
	Total number of groups	2	6	1	2	6	2
	Total number of individuals observed	7	18	5	2	11	4
Indexes	% of sections without gazelles	93.33	98.25	98.04	98.64	93.35	98.1
	Mean number of groups per section	0.067	0.017	0.020	0.014	0.076	0.015
	Mean size of the groups (min - max)	3.5 (2-5)	3 (1-5)	5	1 (1-1)	1.83 (1-2)	2 (1-3)
	Kilometric Index	0.047	0.010	0.020	0.003	0.039	0.006

Table 5: Compared indexes for the evaluation of dorcas gazelles' populations in several regions of central Sahel

		MALI			NIGER							CHAD		
		Zone 1 2005	Zone 2 2005	North Tamesna 2002	Termit MNHN 2002	RNNAT LSC 2001	Termit SSIG 2002	RNNAT SSIG 2002	Agadem SSIG 2002	Erg Bilma SSIG 2002	Manga SSIG 2002	Manga SSIG 2001	Centre SSIG 2001	ROROA SSIG 2001
Data	Total number of sections run	30	24	94	343	355	51	147	93	48	78,4	56,3	132,5	124,5
	Total number of groups	5	8	75	374	91	175					1.145		
	Total number of individuals observed	10	20	239	765	333	212	148	5	0	78	570	496	2.713
Indexes	% of sections without gazelles	93,33	70,83	63,8	55,4									
	Mean number of groups per section	0,17	0,33	0,80	1,09									
	Mean size of the groups	2	2,5	3,2	2,05	3,66								
	Kilometric Index	0,067	0,17	0,52	0,45	0,47	0,83	0,20	0,01	0,00	0,20	2,02	0,75	4,3

RNNAT: Aïr-Ténéré Natural National Reserve (Réserve Naturelle Nationale de l'Aïr-Ténéré)
ROROA: Ouadi Rimé - Ouadi Achim Reserve (Réserve de Ouadi Rimé - Ouadi Achim)

3.4.2. Trial of populations assessment

A *model-based* approach, based on a geostatistical model was impossible, notably because it was not possible to make a reliable model for the functions of spatial autocorrelation observed that means mainly an absence of significant spatial structure.

Therefore, it is possible to use here the classical estimator of total numbers utilized in the case of SRS (Simple Random Sampling). Actually, it is known that for populations so called "in random order" (*i.e.*: for which the spatial structure is not significant) the systematic sampling is, on average, equivalent to the SRS, this being particularly true for dorcas gazelle in zone 2. The results of the trial of populations' assessment are presented in Tables 6 and 7.

On the other hand, nothing allows to calculate a confidence interval using the Student's Law. Thus, we will not present, at the moment, estimates with intervals.

Table 6: Assessment of the gazelles' populations in zone 1

N = total number of sections considered, n = size of the sections' sample, y = number of observations, m = estimated mean - (m = y/n), s^2 = estimated variance of y, T = total number estimated, $s^2(T)$ = variance of T- [$s^2(T) = N(N-n)/n \times s^2$], s(T) = standard-error of T.

Species	N	n	y	m	s^2	**T**	$s^2(T)$	s(T)
Dama Gazelle	205	30	19	0.6333	2.7230	**130**	3256.24	57.06
Dorcas Gazelle	205	30	10	0.3333	2.2299	**68**	2666.57	52.64

Table 7: Assessment of the gazelles' populations in zone 2

N = total number of sections considered, n = size of the sections' sample, y = number of observations, m = estimated mean - (m = y/n), s^2 = estimated variance of y, T = total number estimated, $s^2(T)$ = variance of T- [$s^2(T) = N(N-n)/n \times s^2$], s(T) = standard-error of T.

Species	N	n	y	m	s^2	**T**	$s^2(T)$	s(T)
Dama Gazelle	150	24	6	0.2500	0.5435	**38**	427.99	20.69
Dorcas Gazelle	150	24	20	0.8333	3.2754	**125**	2579.35	50.79

Looking at these results, we thus could estimate, the number of the dama gazelles' population in the two prospected zones to be around 170 individuals. As shown by the standard-error, this estimate is nevertheless very poorly accurate.

N.B. : Our results bring also to the fore the abundance of White-Bellied Bustards in zone 1. This is a very good point since it reveals the good status of habitat's conservation. But, it is also a negative point because the abundance of this bird species can attract many hunters, particularly those from the Arabian Peninsula for who it is a very appreciated game-bird, with obvious risks of gazelle's poaching.

3.5. Genetic analyses

Six samples of pellets were collected: 3 assumed to come from dama gazelle in zone 1, 3 supposed to belong to dorcas gazelle in zone 2.

Amplification products were observed for only two samples, one for each species. Repeated PCR reactions with altered running conditions failed to yield additional amplification products from the other four samples, suggesting a lack of an adequate amount of template DNA. Another explanation is that faecal samples from herbivores often contain secondary plant compounds that inhibit the PCR reaction from happening.

Successful amplifications were subjected to cycle sequencing with KKWRC5 and were electrophoresed on an automated sequencer. Sequencing was successful for each sample although a limited number of nucleotides was resolved for each (299 for the dama sample, 267 for the dorcas sample out of the 1,140 nucleotides of the cytochrome-b gene) due to an excessively noisy baseline. Those outcomes can be expected with poor-quality templates such as those obtained from faecal pellets.

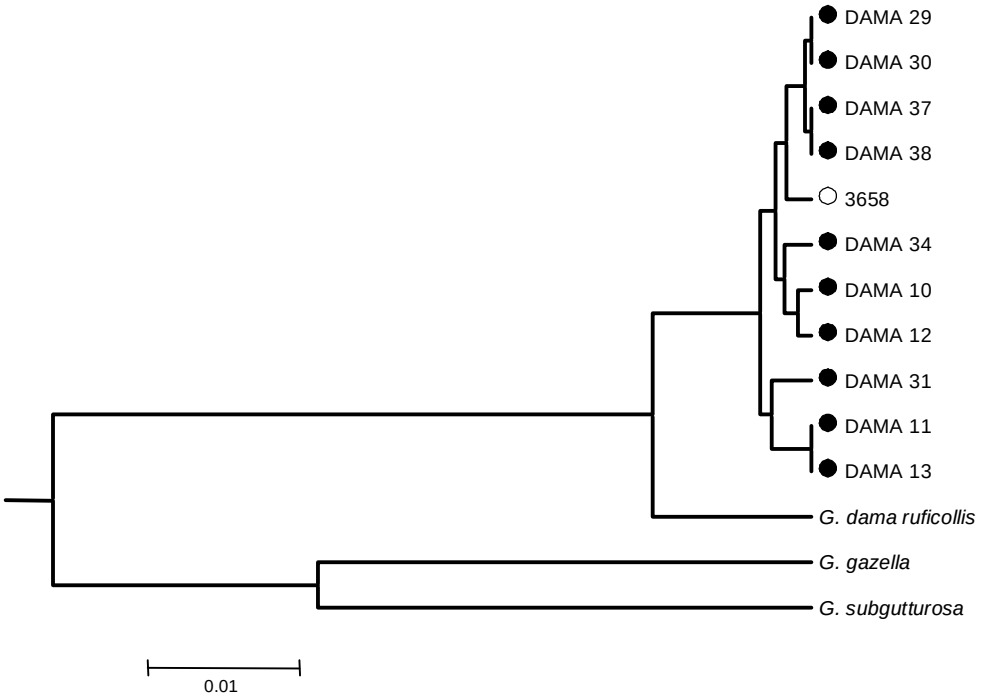
As a first result, one can notice with satisfaction that the identification of the droppings was correctly done in the field.

3.5.1. Dama gazelles

The dama gazelle sequence obtained from dama gazelle N° 3658 was compared to homologous sequences generated in KKWRC laboratory from *Gazella dama dama* samples collected in central Chad in September 2001 and, to a sequence from *Gazella dama ruficollis* of unknown geographic origin obtained from GenBank. Those sequences were aligned and were subjected to phylogenetic analysis by means of a UPGMA tree (Figure 5). The tree was rooted with sequences from idmi (*Gazella gazella*) and reem (*Gazella subgutturosa*). The dama sample from Mali clusters within the group of *Gazella dama dama* from Chad rather than with *G. dama ruficollis* or separately from either. In fact, it differs from Chadian samples 29, 30, 37, and 38 by one nucleotide, indicating recent common ancestry with those individuals.

Thus, within the context of the limited data available, we conclude that the sample from South Tamesna is a member of the same subspecies (*G. dama dama*) and the same conservation unit as those from Chad. It is quite possible that the Mali and Chad dama gazelles' populations represented a much larger, single population in the past.

Figure 5: UPGMA tree of dama gazelle haplotypes for cytochrome b

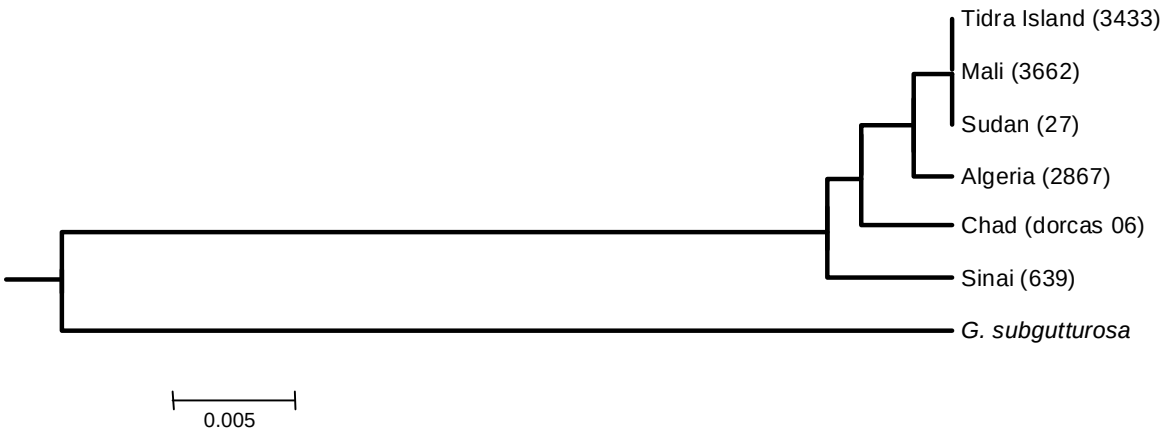


3.5.2. Dorcas gazelles

The dorcas gazelle sequence obtained from individual N° 3662 was compared to homologous sequences of dorcas gazelle generated in KKWRC laboratory from samples from Algeria, Egypt (Sinai), Mauritania, Sudan and Chad using the same method as for dama gazelle.

The dorcas gazelle sample from South Tamesna was identical to a geographically widespread haplotype that has been found previously by KKWRC in dorcas gazelles from Tidra Island, Mauritania, and from Sudan (Figure 6).

Figure 6: UPGMA tree of dorcas gazelle haplotypes for cytochrome b



The haplotype was similar to haplotypes found in dorcas gazelles from Algeria, Chad and the Sinai. This result is suggesting again that dorcas gazelles may be very uniform across the whole southern Sahara from the Atlantic to the Nile, with a hint that they may be partially isolated from those across the north.

3.6. Data on distribution and movements of dama gazelles collected locally

The data which follow are drawn from a study carried out in 2003 for DNCN by the Malian NGO "Nouveaux horizons", based in Ménaka, in the framework of the French cooperation project FSP 2000-130: "*Support to the sustainable management of spaces and resources*". They were gotten through a participative approach aiming at having natural resources' maps established by small groups representative of the communes' populations. Data regarding more specially dama gazelles ("Tenhert" in tamachek) were furnished by the communes of Tidarmène, Alata and Inékar (the spelling of the places' names is that which is indicated on the 1/200.000 IGN maps).

1. There are two nuclei of dama gazelles populations:
   - Ø a nucleus "East" located north to the commune of Inékar, between the valleys of Azaouagh and Azar (localities: Eraman, In Dararane-Tajinjart, Sassaw, Izzarat). This area corresponds to the north of our Zone 1;
   - Ø a nucleus "West", with:
     - o a main range, used for the greatest part of the year, sat astride the communes of Alata and Tidarmène (localities: Aoussi-Amastaôuas-Tassanarab) between the valley of Ezgueret and those of Amastaouâs and Aoussi. This area corresponds to the north of our Zone 2;
     - o a secondary range, used mainly at the end of the rainy season, situated in the commune of Alata, north to Sahen, between the valleys of Ighacher Zeggueghene and Tadriant, at the end of the valleys of Tin Sâkâne, Tin Afghat and Tin Ghaïdan (localities: Tin Ghaïdan, In Arabane, In Tirijant). This area globally delimited by the coordinates: 17°23' - 17°40' N / 03°00' - 03°30' E.

2. Dama gazelles from nucleus "West" would migrate towards North Tamesna via the secondary range during the rainy season (from July).

   The route of these movements, described by the representatives of In-Tédjédit (North Tamesna) would be the following: Ezgueret West (Amastaouâs) - Ighacher Zeggueghene (confluence with Arakad) - Doubène - Tafarawt Tan Wanbadja - confluence Tin Essako/Ighacher Zeggueghene - Tin Tghiss - south of Ténikert - south of Bedar - In Torchawene - In Arabane/In Tirijant – main range (see map 2 in Appendix 2). During this migration, a few individuals would be "stuck" in the secondary range by the pastoral activities until February.

N.B. : The question of a possible western migration of individuals from the nucleus "east" with exchanges with the nucleus "west" could be address. This movement is theoretically possible given the relatively small distance between the two nuclei (as a crow flies, the two zones surveyed are only 230 km apart). Nevertheless, it seems not very probable, as it would imply the crossing of several valleys often and much used by man, as road notably, like Azaouagh, Tadriant or Ezgueret. The possible movements of the sub-population of the nucleus "east" are likely to happen towards the east, in the Nigerian Tamesna.

3.7. Estimate of the dama gazelles' population in South Tamesna

Given the results of the field mission and the data collected beside reliable informants and without anticipating on that which could be numbered by the future aerial census, (see infra), we estimate the number of the dama gazelles' in South Tamesna to be around 250 individuals (170 for the eastern nucleus, 80 for the western one).

This population would be distributed on an area of about 17,500 km² included in a parallelogram of which geographic coordinates are to the west: 17°05' N/01°50' E and 17°40' N/01°50' E, to the east: 16°30' N/04° 12' E and 17°05' N/04° 12' E.

This estimate is much lower than that which was given by Rod EAST for Mali in "*African Antelope database 1998*" (400 individuals). Furthermore, the distribution of dama gazelles mentioned above is also different from that quoted in the same document, since EAST localizes the last dama gazelles of Mali to the north-east of Mopti and to the north of Timbuktu, i.e. more or less 600 km west to the surveyed zones as the crow flies.

Table 8: Last population estimates for dama gazelles in central Sahel

Country	Location	Area km²	Year	Estimated number	Trend	Data category	Source
Mali	South Tamesna	17.500	2005	250	Decreasing	GS, IG, LP	This study
Niger	RNNAT	> 77.360	1990	< 200		GS	Poilecot, 1996
			1991	175	Stable	GS	East, 1999
			2001	Rare	Decreasing	GS	Giboulet, 2001
			2002	Rare	?	GS, IG	SSIG, 2002
	Termit	> 25.000	1991	350	Decreasing	IG	East, 1999
			2002	< 350	?	GS, IG	SSIG, 2002
Chad	ROROA	5.000	1992-93	Uncommon to rare	Decreasing	FO	East 1999
			2001	Rare	?	GS, LP	SSIG, 2001
	Kanem/Batha	> 5.000	1993	Uncommon to rare	Decreasing	LP	East 1999
	Manga	10.000	2001	50-100	?	GS, IG	SSIG, 2001

GS: Ground Survey, IG: Informed Guess by knowledgeable observer with experience in the area, LP: Information on occurrence and estimates of relative abundance and population trend based on reports by local hunters, pastoralists and other rural people, FO: Information on occurrence and estimates of relative abundance and population trend based on field observations by informant.

The Malian dama gazelles' population would thus have a decreasing trend like all the populations of central Sahel for which the last estimates are presented on Table 8. However, this table shows also that, if the estimate given in this report was confirmed by the aerial counting, the damas' population

of South Tamesna would be really a population of paramount importance for the conservation of the species in general and of the subspecies *Gazella dama dama* in particular.

3.8. Training of DNCN agents in SSA monitoring

All the members of the mission (1 French technical assistant, 3 agents of the wildlife administration: 1 from DNCN-Bamako, 1 from DRCN-Kidal, 1 from DRCN-Gao, and 1 consultant specialized in natural resources management) had a theoretical training on the method used and its implementation. This training was reinforced by the practical realization of the exercise during the 5 field days and by the pedagogic methodological document prepared before the mission which was let to DNCN and to the agent of DRCN-Gao. This report which will be widely distributed in Mali will contribute to establish the training on SSA monitoring.

At last, the realization of the aerial surveys planned for the end of this year (see infra) will be another opportunity to train the agents while showing them an other monitoring method suitable for the conditions of the extreme-east of Mali.

4. RECOMMENDATIONS AND PROPOSALS

4.1. Complementary aerial surveys

This mission could not reach all the places presumed to shelter dama gazelles because of the extremely difficult driving conditions met in both the zones surveyed. It is thus impossible to consider that the objective: "make a first assessment of the number of this population" was perfectly achieved. Due to the field constraints, an aerial census is the only solution to complete the exercise and to get a reliable vision of the conservation status of the dama gazelles' populations in South Tamesna.

Several criteria presided over the choice of the areas where an aerial survey should be carried out:

- **Ø** the date scheduled for the exercise: October November, incites to add a central zone to the two dama gazelles' ranges east and west already surveyed. Actually, it is the period when one part of the damas from western population is still susceptible to stay north to Sahen (See § 3.6.1.);
- **Ø** the observations realized during the field mission;
- **Ø** the information collected beside local people knowing well the area.

Three zones were thus retained (map 3, Appendix 2): "East", "Center" and "West.

4.2. Conservation measures

4.2.1. Hunting control

Problematic

Obvious signs of hunting were recorded in both the prospected zones, these signs being notably more numerous in the places easy to reach where the driving conditions are quite fair. Consequently, the wildlife density is very low there. This is perfectly illustrated by the south of zone 2 where the vicinity of the road Ménaka-Kidal and the flat relief lead to a quasi-total absence of wildlife, or, also by the fact that dama gazelles or their signs of presence were only observed in particularly inaccessible and impassable areas.

The hunting of which control seems to escape to the local services of DNCN devoid of any means to carry out an efficient action, as well as to the local authorities and populations, is likely to have a deep impact on the South Tamesna wildlife.

This is maybe particularly true for the recreational hunting done by the " Gulf princes", sometimes qualified as "VIP guests " who regularly carry out real expeditions with huge logistics in every zone where there is "game" left. We noted a very hostile reaction of the local authorities met in Ménaka facing the "Arabic Princes". Actually, the local communities are perfectly aware that wildlife of which management was delegated to them with the decentralization laws, is being exterminated even before they could exercise their new prerogatives and that, without they have been consulted and (above all) without they earn any benefit of this exploitation.

Recommendations

Is would be completely non-productive to forbid totally hunting, for, well managed, it is a very efficient mean to conserve wildlife. Thus, the following proposals aim at guaranteeing the preservation of a hunting capital which could be exploited in the long-term:

1. Suspend hunting in South Tamesna until the setting-up of a reliable monitoring of the hunted populations

   It seems to us very hazardous to consider any exploitation by hunting (to which we should add poaching) without setting before a monitoring of the populations of the species allowed to be hunted. A device as simple to implement as the KI would give already a rough idea of the populations dynamics.

   It could be imagined for instance to suspend totally hunting for two years, these years being used to define a reference KI (year 1, after the legal hunting period) and a first "comparative" KI (year 2, at the same period) and to fix a "pilot" hunting quota voluntarily low (conservative) for year 3, first year of exploitation. The following years, KI would be regularly assessed each year, always at the same period and following the same route and methodology, to appraise the impact of hunting and to adapt the hunting quotas in consequence.

2. Attribute hunting concessions to the Gulf Hunters with very detailed and coherent specifications

   Given the economic and political stakes implicated by the arrival of the Gulf Hunters, it seems totally unrealistic to proscribe it. A pro-active approach associating these actors to the conservation process appears to be very much more relevant.
   It could be recommended, as it has been proposed in other countries facing the same problematic, to attribute hunting concessions to Gulf Hunters or their representatives. The concession should be accompanied by extremely precise specifications.

3. Promote the creation of community hunting zones and forbid completely hunting outside all the zones specially devoted to hunting

   Theses community hunting zones would complement the network of the zones devoted to hunting formed by the ZHI and the Hunting concessions to the Gulf Hunters. The hunting outside these special zones would be forbidden and thus considered as poaching and punished as such.

4.2.2. Creation of protected areas

It is clear that the only recommendations regarding hunting mentioned above, would not be sufficient to guarantee the protection and the conservation of dama gazelles which are endangered both by a selective hunting pressure by poachers coming notably from Niger and by their habitat's fragmentation and destruction.

It is thus necessary to recommend the creation of protected areas to complement the system initiated by the setting of zones specially devoted to hunting. The proposal made in the final report of the socio-economical study realized by "Nouveaux Horizons" called "*Programme de gestion et de préservation de la faune dans l'Adagh et le Tamasna: Schémas et plan de gestion des aires protégées*" ("Management and wildlife preservation program in Adagh and Tamasna: Figures and managements plans for protected areas"), seems very relevant.

Actually, this report proposes to set up a PA's network some of which covering perfectly the dama gazelles ranges confirmed by this mission (See map 4 in Appendix 2). These PA are:

- The main Tamesna reserve (RPT: Réserve Principale du Tamesna): The proposed borders of this reserve straddling the Kidal and the Gao regions, include the "secondary range" of the nucleus "west" and the greatest part of the migratory route of the dama gazelles of this nucleus.
- The natural integral reserves of Azawagh North and Zdjaret West: These reserves cover respectively our zones 1 and 2.

CONCLUSION

The objectives of the mission: confirm the existence of dama gazelles in Mali, locate the population(s) and assess the number of the groups, train DNCN agents to SSA monitoring, recommend conservation or further monitoring measures for SSA populations, were globally reached.

Nevertheless, given the field constraints, only an aerial survey of the three zones susceptible to shelter dama gazelles would allow to complete the exercise and to get a reliable vision of the species status in South Tamesna.

On the other hand, due to the omnipresence of hunting in the whole area surveyed, its obvious impact on wildlife and the impossibility for the local administrative services and the territorial collectivities to manage it, it urges to set up a series of measures aiming at controlling this activity. Furthermore, the creation of protected areas is also to be recommended. Thus, we suggest the quick setting up of the Main Reserve of Tamesna and of the natural integral reserves Azawagh North and Zdjaret West.

ACKNOWLEDGEMENTS

This mission could not have been carried out without the involvement of numerous institutions and persons that have contributed to its success not only in the field but also before and after.
Thus, thanked be here:

The SSA CMS/FFEM project and the Saint Louis Zoo, Missouri, USA, which sponsored and funded this mission and particularly: Moulay Lahcen EL KABIRI, CMS Deputy executive secretary, Roseline BEUDELS, Focal Point of the CMS SSA concerted Action, Arnaud GRETH, regional coordinator of the SSA project, Eric MILLER and Bill HOUSTON, respectively Director of the Saint Louis Zoo's Wild Care Institute and Assistant General Curator at Saint Louis Zoological park;

The National Direction of Nature Conservation in Mali and the "*Service de coopération et d'action culturelle*" of the French Embassy in Bamako which made available the right human and logistics means for the good implementation of this mission. These acknowledgements go particularly to Félix DAKOUO and Baïkoro FOFANA, respectively director and deputy director of the DNCN, to his Excellency Nicolas NORMAND, ambassador of France in Bamako and to Sandrine BRIGNONEN from SCAC.

All those who gave a scientific and technical support for the processing of the data collected in the field, namely: Philippe AUBRY and Philippe LANDRY from the ONCFS "*Direction des études et de la recherche*" who respectively performed the statistical analysis and made the maps, as well as Drs. Kris HUNDERTMARK and William MACASERO from King Khalid Wildlife Research Center of Riyadh, Saudi Arabia, who realized the genetics analyses.

And of course, all those who followed, without complaining, this field mission particularly tiring: Aboubacrine AÏDARA, Chief of Nature Conservation Service in Ménaka, Amewey AG SID'AHMED, Regional Director of Nature Conservation in Kidal, Soghi AG ILAJI, driver of DRCN-Kidal, ASSOKAL, emeritus tamachek guide, Stéphane BOUJU, French adviser of the Minister of Environment, Gaoussou COULIBALY, in charge of Washington convention at DNCN, Daouda MAÏGA, chairman of the NGO "Nouveaux Horizons" and Mohamed OFEN, sharp-sighted driver.

APPENDICES

1. REFERENCES

ARBONNIER, M. (2000). Arbres, arbustes et lianes des zones sèches d'Afrique de l'west. CIRAD - MNHN - UICN. 542 p.

AUBRY, P. & DEBOUZIE, D. (2000). Geostatistical estimation variance for the spatial mean in two-dimensional systematic sampling. Ecology, **81**: 543-553.

AUBRY, P. & DEBOUZIE, D. (2001). Estimation of the mean from a two-dimensional sample: the geostatistical model-based approach. Ecology, **82**: 1484-1494.

BORROW, N. & DEMEY, R (2001). Birds of Western Africa, Helm Identification Guide. Christopher Helm, A & C Black, London, 832 p.

CLARO, F. (2004). Observations of antelopes in the greater Termit area, Niger in 2002. pp: 47-51 *In*: Chardonnet B. & Ph. Chardonnet. Antelope Survey Update. Number 9: November 2004. IUCN/SSC Antelope Specialist Group Report. Fondation Internationale pour la Sauvegarde de la Faune, Paris, France.

EAST, R. (1999). African Antelope Database 1998. IUCN/SSC Antelope specialist group. IUCN, Gland, Switzerland and Cambridge, UK, 434 p.

GIBOULET, O. (2001). Programme de Réhabilitation d'urgence des réserves naturelles et intégrales de L'Aïr et du Ténéré. Mission d'évaluation rapide des effectifs de faune dans l'Aïr Ténéré - 05 mars - 27 mars 2001 - Rapport de mission. République du Niger - Centre du Patrimoine Mondial – UNESCO, DFPP, UICN, ANN, LSC, 53 p.

HUNDERTMARK, K. & MACASERO, W. (2005). Genetic identification of gazelles from Mali. Supplemental report – Preliminary. Molecular Genetics laboratory, King Khalid Wildlife Research Centre, National Commission for Wildlife Conservation and Development, Kingdom of Saudi Arabia, 3 p.

IUCN (2004). 2004 IUCN Red List of Threatened Species. www.redlist.org. Downloaded on 23 March 2005.

JACHMANN, H. (2001). Estimating abundance of African wildlife: an aid to adaptative management. Kluwer, Norwell, USA, 285p.

KINGDON, J. (1997). The Kingdon field guide to African mammals. Academic Press, San Diego. 476 p.

LAMARQUE, F., STAHL, P. (2002). Guide méthodologique d'étude et de suivi de la faune du Tamesna, Office National de la Chasse et de la Faune Sauvage, Mission des Actions Internationales, Direction des Etudes et de la Recherche, 21 p.

MONFORT, S. L., NEWBY, J., WACHER, T., TUBIANA, J. & MOKSIA, D. (2004). Sahelo-Saharan Interest Group Wildlife Surveys. Part 1: Central and Western Chad (September-October 2001). ZSL Conservation Report No. 1. Zoological Society of London, iii + 54 pp.

NOUVEAUX HORIZONS (2003). Etude socio-économique et physique portant sur l'inventaire de la faune et de la flore dans le Tamasna et l'Adagh des Iforas réalisée pour le compte de la Direction Régionale de la Conservation de la Nature de Kidal dans le cadre du Projet FSP 2000-130. Rapport final. 85 p, Appendices.

NOUVEAUX HORIZONS (2004). Programme de gestion et de préservation de la faune dans l'Adagh et le Tamasna. Schémas & plan de gestion des aires protégées. Etude réalisée pour le compte de la Direction Régionale de la Conservation de la Nature de Kidal dans le cadre du Projet FSP 2000-130. Rapport final. 40 p, Appendices.

POILECOT, P. (1996). La faune de la Réserve Naturelle de l'Aïr et du Ténéré, pp. 181-255 *In*: F. Ghiazzi: La Réserve Nationale Naturelle de l'Aïr et du Ténéré. Analyse descriptive. MH/E, WWF et UICN. Gland, Suisse. 678 p.

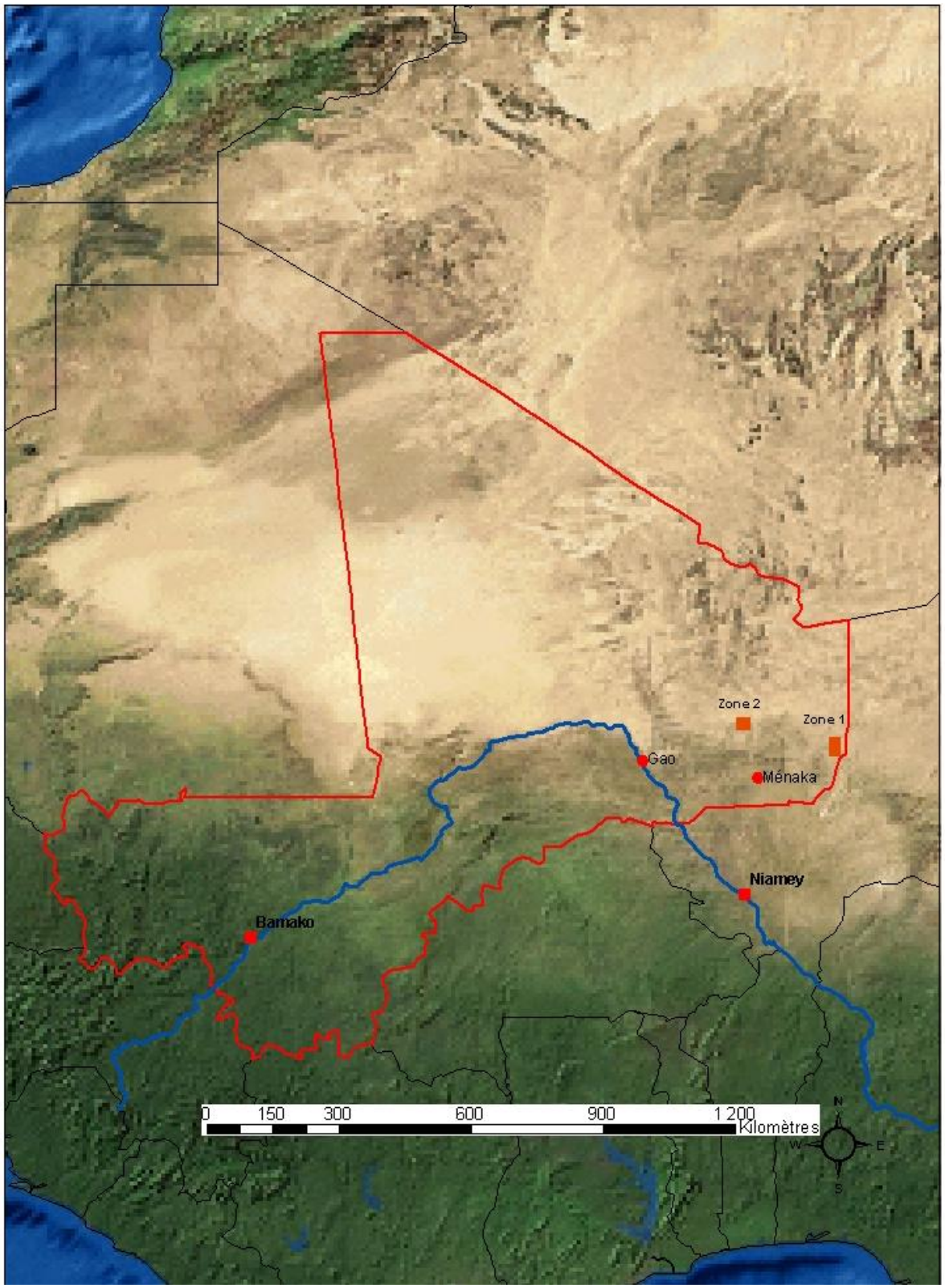
UICN (1994). Catégories de l'UICN pour la Liste Rouge. Commission de la sauvegarde des espèces de l'UICN. UICN, Gland, Suisse et Cambridge, Royaume Uni, 22 p.

UICN (2000). Catégories et critères de l'UICN pour la Liste Rouge: Version 3.1. Commission de la sauvegarde des espèces de l'UICN. UICN, Gland, Suisse et Cambridge, Royaume Uni, ii + 32 p.

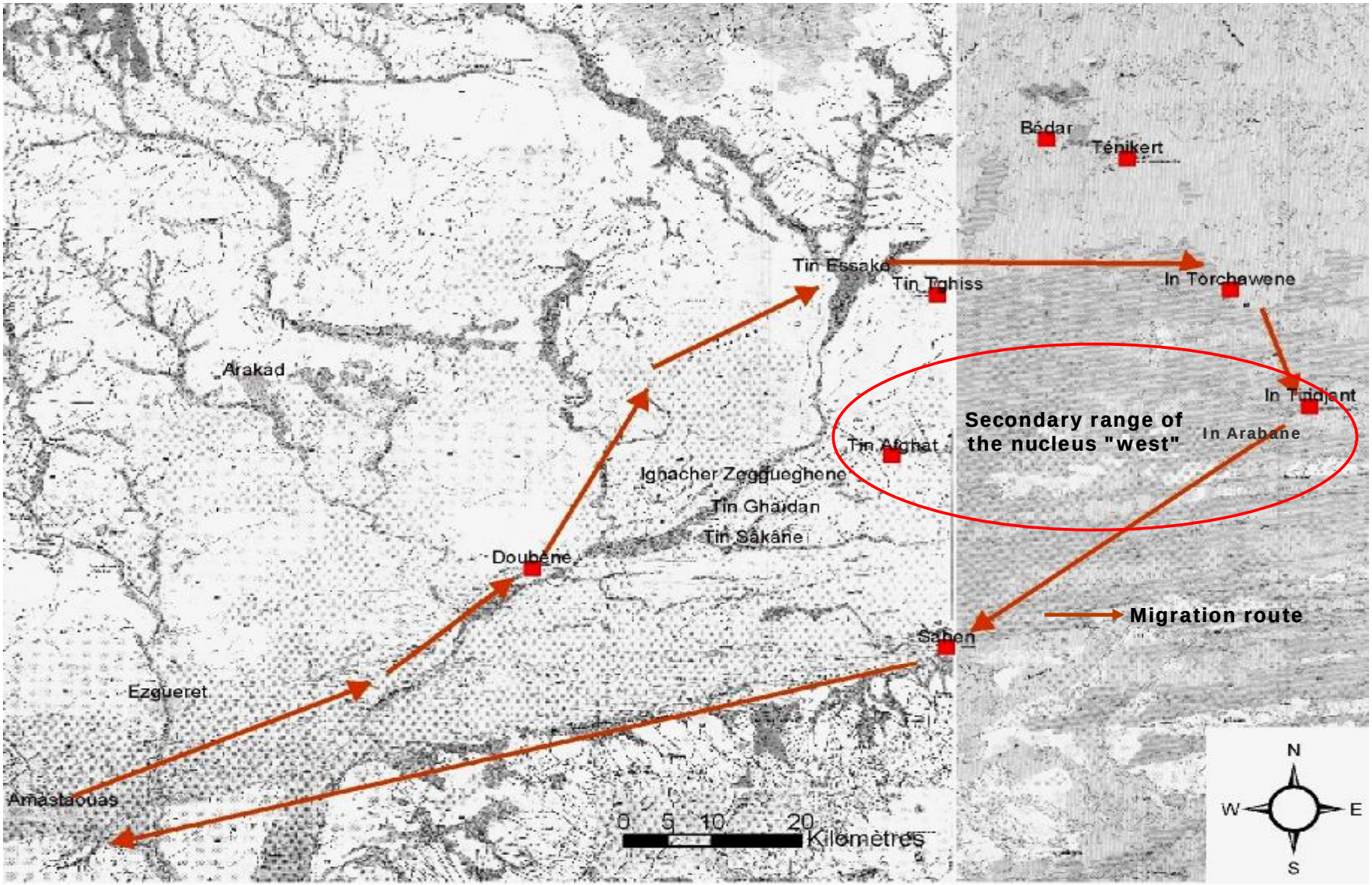
WACHER, T., J., NEWBY, J., E., MONFORT, S., L., TUBIANA, J., MOKSIA, D., HOUSTON, W. & DIXON, A., M. (2004). Sahelo-Saharan Interest Group Antelope Update, Chad 2001 and Niger 2002. pp: 52-63 *In*: Chardonnet B. & Ph. Chardonnet. Antelope Survey Update. Number 9: November 2004. IUCN/SSC Antelope Specialist Group Report. Fondation Internationale pour la Sauvegarde de la Faune, Paris, France.

2. MAPS

Map 1: Localization of the zones surveyed



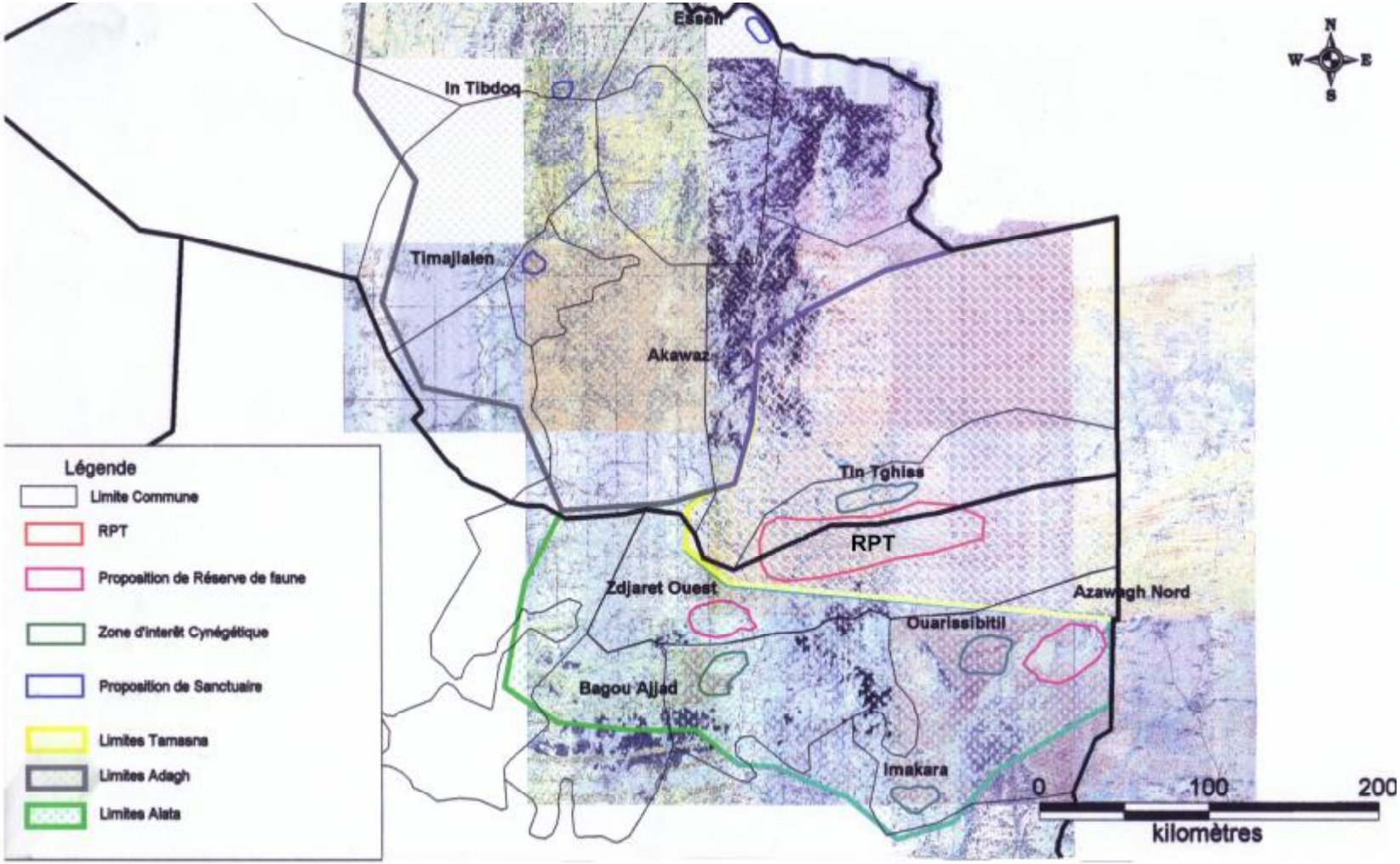
Map 2: Secondary range used by the nucleus west and assumed migration route



Map 3: Situation of the three zones to be flown over

Map 4: Localization of the PA's suitable for the conservation of South Tamesna's dama gazelles

(From: NOUVEAUX HORIZONS (2004)**.** Programme de gestion et de préservation de la faune dans l'Adagh et le Tamasna. Schémas & plan de gestion des aires protégées)



3. FORM "HABITAT"

- The observations are made on about 500 m on each side of the transect.

- **For each Habitat descriptor** (for instance "undulation", "dune", "soils: sand or sand plus clay", "soils: sans plus gravels", "reg", "herbaceous vegetation steppe", etc.), **only one box must be notched**, indicating the total absence of the regarded habitat on the section or the rough % that it forms on the length of this section. For instance, for the habitat descriptor "undulation": notch "abs" (that means "absence") if no undulation was seen on the section; notch "- 25" if undulations have been observed and fill less than 25% of the section length, notch "25 to 50" if the undulations met fill from 25 to50% of the section length and notch "+50" if the undulations fill more than 50% of the section length.

- **For the descriptors " Human activities", several boxes can be notched** (several types of activities can be observed on a same section). **Notch no box when no human activity is recorded:** pers = persons; donk. = donkeys; drom = dromedaries (fill with a D) – zebus (fill with a Z).

Tran- sect	Sec- tion	Undulation				Dunes		Soils										Herbaceous Vegetation						Trees						Human activities						
								Sand or sand + clay			sand + gravels			reg				steppe			patches			Isolated trees			"thickets"									
		abs	- 25	25 to 50	+ 50	yes	no	abs	- 50	+ 50	abs	- 50	+ 50	abs	- 25	25 to 50	+ 50	abs	- 50	+ 50	abs	- 50	+ 50	abs	- 50	+ 50	abs	- 50	+ 50	well	camp.	pers.	sheep-goats	donk.	drom. zebus	Car tracks.

4. FORM "WILDLIFE OBSERVATIONS"

General Information

Date:	
Team: (Names, functions)	
Weather conditions: visibility, temperature, etc.	

Survey data

Transect	Section	Coordinates Section*		Hour**	Species	Group size	Coordinates Observation	Gazelles	
		Latitude N	Longitude E					Distance detection	Beha-vior

* Coordinates recorded on the GPS at the beginning of each section. ** Hour at the beginning of each section.

Our Present Projects with Sahelo-Saharan Antelopes Countries.
Mar Cano & Teresa Abaigar

In this moment we are involved in antelopes conservation projects in the following Sahelo-Saharan countries: Tunisia, Morocco, Mauritania and Senegal and an application for a project in Algeria has also been presented. Some details on each one are here explained.

TUNISIA

Project title:
Détermination du statut de la Gazelle de Montagne (*G. cuvieri* Ogilby, 1840) et de la Gazelle Dorcas (*G. dorcas*, Linnaeus, 1758) dans la Dorsale Tunisien: situation actuelle et perspectives de conservation.
(Determination of the status of Mountain Gazelles (G. cuvieri, Ogilby, 1840) and of the Dorcas Gazelle (*G. dorcas,* Linnaeus, 1758) in the Tunisian Ridge: current situation and prospects for conservation.)

Background:
During the SSIG meeting held last year at Souss (Tunisia), Teresa engaged in participating in the survey of Cuvier's and Dorcas gazelles in the Tunisian Dorsal mountains, in the frame of the Tunisian National Strategy for the Conservation and Restoration of Sahelo-Saharan Antelopes and its Habitats. This project aims with the catalogue of Sahelo-Saharan antelopes and it habitats.

Project objectives:
General objective:
Determination of the present situation of both species in the Tunisian dorsal mountains.

Specific objectives:
1) Assess the presence/absence of Gc and Gd in the Tunisian dorsal.
2) Evaluation of favourable habitats for the presence of both species.
3) Conservation measures proposals.

Participants:
Tunisia: DNP
Spain: TA and MC (EEZA-CSIC)

Financing:
DPN
CSIC
FFEM

Project Planning:
- Workshop for methodology coordination with all the participants in spring 2005
- First prospecting in Tunisia (Zaghouan area) in spring 2005.
- Second prospecting (Kairouan area) in early autumn 2005.
- Third prospecting (Kasserine) in late autumn or winter 2005.
- Results and final rapport in march-May 2006.

Present Situation And Previsions
In this moment we are attending the resolution of some administrative aspects to initiate the work as soon as possible.

ALGERIA

Project title:
Feasibility study for the reintroduction of Cuvier´s Gazelle (*Gazella cuvieri*) and Barbary Sheep (*Ammotragus laervia*) in Belezna National Park (Argelia).

This study, included in a wider project of support to public use and ecotourism in Belezna and Ifrane National Parks, has as objectives the ecological and sanitary assessment of the national park and the evaluation of the institutional and scientific collaborations in order to determine the viability of reintroductions.

Financing:
Demanded to the Spanish Junta de Andalucía.

MOROCCO

Project title:
Genetic characterisation of Moroccan Dorcas Gazelles (*Gazella dorcas ssps*). Application to its management and conservation.

Background:
During the CMS and SSIG meetings held in Agadir (Morocco) in may 2003, the local Eaux et Forêts (Water and Forests) authorities contacted us for working jointly in the genetic identification of the different populations of dorcas gazelle in order to get the adequate knowledge for the species management.

Dorcas Gazelle got a status near to extinction in Morocco but nowadays, after years of effective protection the species is becoming recovered and at present populations of dorcas gazelles can be found in splendid conditions in several protected areas, such as Souss-Massa NP, Reserve R'Mila, Res. M' Sabih Talah (Sidi Chiker), Res. Bouacila, Res. Jbilet, Res. Bouznika, Res. El Kheng, Res. Amassine, so as in Rabat Zoo.

This protected populations are increasing in numbers of animals and in June 2004 we could find the following data:

- Jbilet Reserve: 180 G dorcas in 280 fenced ha (1,56 ha/gazelle);
- R'Mila Reserve: 500-600 G dorcas plus 103 Mohor gazelles in 506 fenced ha;
- M'Sabih Talah Reserve: 800 G dorcas in fenced 2.000 ha (2,5 ha/gazelle)
- Bouacila Reserve: 150 G dorcas in 300 fenced ha (2,0 ha/gazelle)
- El Kheng Reserve: 40 G dorcas in 600 fenced ha (15 ha/gazelle),
- what that means in the near future is that it is foreseen that the reserve's carrying capacity will be reached and if no management decisions and population management are taken prior to get the carrying capacity, the present breeding success and protection will turn in a problem.

Two different subspecies had been described in Morocco: *G. d. massaesyla = G. d. cabrerai* in the plateaux north and central and *G. d. neglecta* in the south and southeast.

Project objectives:

1) Genetic identification of the different *G. dorcas* populations of known origin and representing all phenotypes, via Mitochondrial DNA analyses and microsatellites.
2) Suggestions for the species management.

Participants:

- Morocco: Prof. L. OURAGH (IVR-Univ. Mohamed V, Rabat), Dr. A. ESSALHI (Vet. Zoo Rabat, Eaux et Forêts), Dr. A. DAALI (Eaux et Forêts-GTZ).
- Spain: Dra T. ABAIGAR, Dra. M. CANO (EEZA-CSIC).

Financing:

- Institute for Veterinary Research (IVR) and Eaux et Forêts department,
- CSIC,
- Inter-University Moroccan-Spanish Joint Committee 2004-05.

Project Planning:

- Visit of Spanish researchers to Morocco in spring 2004
- Samples analyses to be finished in December 2004
- Visit of Moroccan researchers to Almeria

Present Situation And Previsions

A set of samples representing the Almeria's captive population founders were sent to the IVR-Rabat and analyzed.

Visit of TA and MC to the Moroccan reserves of Jbitet, R'Mila, M' Sabih Talah, Res. Bouacila and Res. El Kheng (june-04) in order to determine possible phenotypical differences among the populations and to decide the reserves where samples might be obtained.

Visit of Drs. Ouragh and Essalhi in Almeria (feb-05) allowed both parties detail aspects of the project and establish a final calendar.

The analysis performed up to the moment has been done on the cytochrome B of the mitochondrial DNA and on nine amplified microsatellites, of them seven bovines and two ovines among those recommended by the International Society of Animal Genetics (ISAG)

Analysis of Moroccan specimens pending for a delay in obtaining samples.

MAURITANIA

Project title:

Survey of Dorcas Gazelle *Gazella dorcas* in Banc d'Argüin NP.

Background:

During the 2002 SSIG meeting in Slomenice, François Lamarque, Teresa Abaigar and Mar Cano committed in a survey of the Mauritanian Banc d'Argüin NP. In Agadir-03 Françoise presented his visit to the isle of Tidra. In early 2003 we presented a demand for financing but had no success in that moment, coincident with political problems and with the lack of the correspondent authorisation of the Scientific Council of the BANP.

We have been notified some weeks ago that we'll have budget for the present year to perform the survey.

Project objectives:

1) Determine the present status of dorcas gazelle in the Banc d'Arguin NP
2) Identify the population trends during the last years and, in accordance with the results, elaborate:
3) Recommendations for its conservation.

Project Planning:

- Survey in representative areas of the National Park in early november-2005
- Participants:
- Mauritania: Local authorities
- Spain: M. CANO, T. ABAIGAR (CSIC)

Financing:

- Spanish Ministry for the Environment
- Mauritanian Banc d'Argüin
- CSIC

SENEGAL

Project title:
Reintroduction of Dorcas Gazelle (*Gazella dorcas*) in Senegal.

Background:
Dorcas gazelle disappeared in Senegal. The Senegalese DPN expressed its interest in the reintroduction of this species (Almería-01) and during the Agadir-03 meeting it was seen that the dorcas population from Western Sahara in the captive breeding program in Almeria (Spain) *G. dorcas neglecta*, was appropriate for the species restoration in this country.

Project objectives:

- Selection and preparation of +- 20 captive bred dorcas gazelles, transfer to the Senegalese RSF Gueumbeul and 1st year monitoring.
- Specific formation and training of personnel from Gueumbeul prior to the animals transfer.
- Creation of a Visitor's Centre in Gueumbeul
- One year research and monitoring of the population.

The project considers and adaptation period for the animals in the REF of Gueumbeul before releasing them in semi wild conditions.

Participants:

- Senegal: Direction des Parcs Nationaux (DPN) (RSF Gueumbeul)
- Spain: T. ABAIGAR, M. CANO (PRFS-EEZA-CSIC) and Barcelona Zoo.

Project Planning and financing:
1st Phase:

- Mending of the perimeter fence in Gueumbeul (DPN)
- Building of three enclosures (two pens for reproductive groups and one for surplus males) (EEZA-DPN)
- Adaptation of a visitor's centre (DPN-Barcelona Zoo-EEZA)

2nd Phase:

- Animals selection and preparation (EEZA)
- Training course on the species management for the person in charge at Gueumbeul (DPN-EEZA-OTHERS)
- Animals transfer-translocation (EEZA-DPN-OTHERS)
- Monitoring and control of the initial adaptation (nutritional change) (EEZA-DPN)

3rd Phase:

- Research and monitoring of the reintroduced population (1 student, 1 year) (Barcelona Zoo-EEZA-DPN)

Financing:

A) Obtained:
1st Phase

- Spain: Education and Research Ministry (MEC): 25.000 €; Barcelona ZOO: 30,000 €; CSIC: research and technical support and animals donation.
- Senegal: Fence mending and pens building labours.

B) Not obtained yet for:

- 2nd phase: Training course for 2 persons (5.800 €)
- 2nd phase: Animals transfer (48.000 €)
- 2nd phase: Material and return travel (11.000 €)
- 3rd phase: One student during one year.

What Has Been Done

A representation of the Senegalese party headed by Cor. M. B. GUEYE, Director of National Parks and Com. I. DIOP, Person in Charge of DPN for the Senegalese northern National Parks and Reserves visited the animals and facilities in Almeria last January . In the course of this visit we could detail different aspects of the project and establish a working calendar.

Last April, TA and MC travelled to Senegal with the design of reception pens in order to select the materials, get the best prizes in Senegal and select and mark the site of the enclosures to be build in Gueumbeul Special Faunal Reserve

Anticipated timetable:

- External fence and enclosures to be finished by end of July-05
- Visitor's centre to be finished in December-05
- If pending financing is obtained:
- Selection of animals and grouping in Almeria in september-05
- Training course in Almeria in september-october-05
- Animals transport in february-06

Other Actions In Senegal

Apart from this project we were invited to impart a course on Sahelo-Saharan fauna in St. Louis in the frame of a project for the creation of a Biosphere Reserve in the Delta of the Senegal River, foreseen as a trans-boundary reserve including territories of Senegal and Mauritania. The five days course took place in july-04.

Mar Cano
Teresa Abaigar
May-2005

Dorcas Gazelles' Survey in Tidra Island - Parc National du Banc d'Arguin (Mauritania)

*António Araújo, François Lamarque** & Louis-Gérard Martin d'Escrienne*

This paper presents the results of a total count of Tidra's dorcas gazelles carried out on 26th November 2004 by PNBA and ONFCS' agents. This count was realized during a training session on nautical surveillance implemented for PNBA staff by ONCFS.

1. FRAMEWORK AND OBJECTIVES

Background

The Tidra gazelles are probably the most western dorcas population in Africa. They are totally isolated from other dorcas populations. Actually, Tidra is separated from the continent by an arm of the sea large enough to make wildlife exchanges impossible even during the lowest tides. It is told that dromedaries would have crossed this arm thirty years ago during the great drought of the seventies; it is not obvious that dorcas gazelles did also cross at that time. Anyway, the isolation of this population has lasted for thirty years at least.

Like all PNBA mammals, gazelles were not much studied although they are a textbook case highly interesting for several reasons:

1. They constitute a meta-population that has evolved in isolation over several generations;
2. They are living in a very particular limited habitat which could have generated behavioural and alimentary adaptations;
3. Given their insular position they are naturally protected from human activities and likely have few human and animal predators (mainly jackals, more maybe raptors mainly for young individuals).

The number of about 15 individuals is often quoted as an estimate for the Tidra dorcas' population although no systematic census has been done to date.

1.2. Objectives

The main objective is to carry out a comprehensive census of the Dorcas gazelles on Tidra to:

1. Have the estimate the most accurate possible of the number of this population;
2. Make a rough analysis of the structure of the population;
3. Get a first idea of its distribution on the island according to the habitat;
4. Eventually, appraise the nature and abundance of the potential predators of the dorcas gazelles.

This census should not be considered as an end in itself but rather as the beginning of a series of in depth studies.

2. METHOD

2.1. Study area

Tidra island is located in the south-west of PNBA, more or less in front of the Iwick head-quarters. The island is about 30 km high (north-south) and 10 km wide (west-east).

2.2. Method proposed

Given the nature of the field, the relief, the good visibility and the open vegetation a complete census of the island dorcas population was considered.

The method proposed was the following:
15 transects east-west 2 km apart run by groups of 2 observers. The observers must keep in visual contact with the two groups which flank them and walk at the same speed in order to form the walking line the straightest possible.

The animals cutting the line formed by the observers in the direction opposite to the walking will be only numbered. The animals will be observed with binoculars to collect data on the sex, the age class and the body condition. To avoid double count, the observers will only consider the animals passing on their right hand side. The group of observers situated at the extreme left will number also the animals passing on their left hand side, between them and the shoreline. On the other hand, all the observers could also number the animals passing on their left hand side on a different form which will allow to check that all the individuals have been correctly detected.

2.3. Method implemented

Due to the number of people available for the census (9 instead of 30) and the difficulties to accost in several points of the island, the method proposed has to be adapted.

All the observers landed at the same point called Zbaratlequaart (19°45'268 N – 16°21'150 W). Then, two teams were formed: one of 4 observers forming a line walking to the North of the island on four transects and one of 5 observers forming a line walking to the South of the island on five transects.

All the observers of each line began the running of the transects at the same hour and made their best to keep in visual contact with the two observers situated at their right and left hand-sides.

All the observations of wildlife (species, group size, sex if possible and geographic coordinates for the 3 observers of each line who had a GPS) were recorded whenever they occurred as well as a short description of the habitat where the animal was observed.

To avoid double counting were also recorded:

- Ø the hour of the observation;
- Ø the direction of the flight of the animal(s).

This ultimate disposition led to cancel 12 observations and likely to underestimate the real number of the dorcas' population.

The signs of dorcas gazelle's presence (spoors, skulls) were also noted.

3. RESULTS

3.1. Qualitative inventory of the existing species

3.1.1. Mammals

Only two species were observed on the island.
The number of contacts and of the animals possibly counted twice are shown in Table 1.

Table 1: Mammals observed on Tidra island

Species	Number of contacts	Possible double counting	Minimum estimate
Gazella dorcas	49	12	37
Canis aureus	9	0	9

Some signs of presence of theses species were recorded (spoors and skulls) when the corresponding animals were not seen. These signs are presented in Table 2.

Table 2: Signs of mammals' presence noted on Tidra island

Species	Spoors	Skulls
Gazella dorcas	>10	2
Canis aureus	14	0

Due to the method used and to the small size of the island it is difficult to appraise if some of these presence signs could belong to individuals not seen by the observers. Nevertheless, according to the people who carried out the survey, this seems to be improbable, all the animals present on the island having been counted.

3.1.2. Birds

Although they were not the main target of the exercise, the birds were also noted by the observers. Five species of birds were so recorded on Tidra. The names of these species and their numbers are shown in Table 3.

Table 3: Birds observed on Tidra island

Latin names	English names	Number
Alaemon alaudipes	Hoopoe Lark	6
Anthus cinnamomeus	Grassland Pipit	2
Bubo bubo	Eurasian Eagle Owl	2
Burhinus oedicnemus	Stone Curlew	2
Falco tinnunculus	Common Kestrel	2

3.2. Structure of the Tidra dorcas' population

3.2.1. Group size

Fifteen groups of Dorcas gazelles were recorded. The mean size of the group on Tidra is thus 2,47, which is perfectly consistent with the results of all the last Dorcas surveys made in Niger and Mali (between 3,7 and 2). Nevertheless the median size is 1, *i.e.* solitary gazelles are the most common formation met. On the other hand, one herd of 16 individuals was observed once; it seems that this herd is stable since it was already mentioned to us by a park warden two years ago when we made the first preliminary survey on the island.

3.2.2. Sex Ratio and age structure

Only 8 individuals could be sexed by the observers out of which 4 were males and 4 females, *i.e.* a sex ratio of 1:1.

Only one individual was classified as young. The data available do not permit to say if that means that there was only one youngster or if the age class was not identified for all the observations. The first hypothesis could be the good one since the survey was made in November possibly just before or at the beginning of the calving season (November-December in Chad according to Haltenorth).

3.3. Distribution of the dorcas gazelles

The habitat where were seen the gazelles is mentioned for 10 observations out of 15. No specific habitat can be identified for the Dorcas since they were observed on small dune with thorny scrubs 4 times, on consolidated dunes with *Euphorbia sp*. 3 times, on dunes with *Acacia tortilis* and *Bauhinia rufescens* two times and in steppe with thorny scrubs once.

It is obvious that Dorcas gazelles exploit all the island to find their food. *Acacia tortilis* and *Bauhinia rufescens* are likely to be heavily searched for; we could note two years ago several fresh spoors around a dwarf *A. tortilis.*

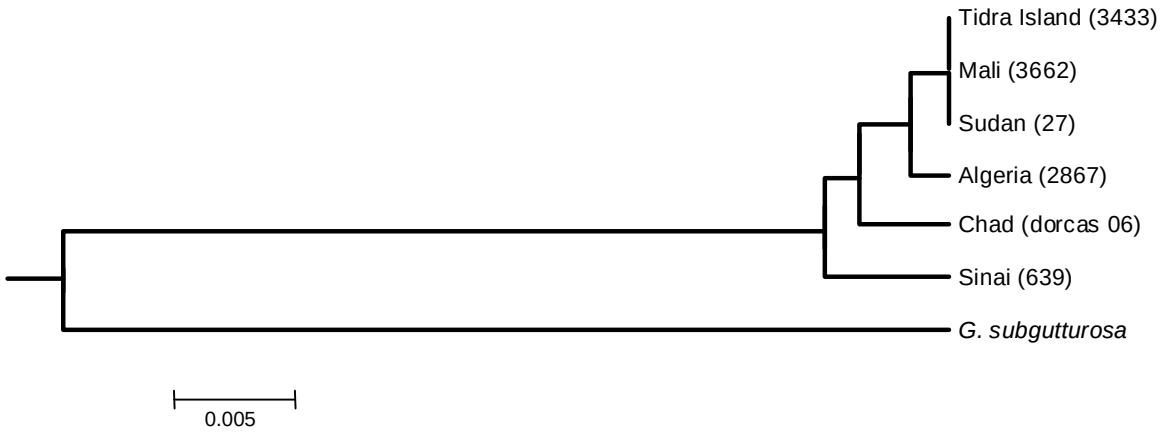
On the other hand, no evidence of exchange with the main land could be noted. None of the spoors observed go towards the shoreline and the sea, no gazelle seen fled towards the water.

3.4. Current knowledge on the Tidra island's Dorcas gazelles

With the results of this survey and the data collected two years ago, we have now a better albeit very rough knowledge of the Tidra's population of Dorcas gazelles.

1. The population would number around 40 individuals;
2. There would be a "big" herd of about 16 individuals and several small groups of one to three individuals;
3. Several jackals, potential predators (at least for the calves), are present on the island or come to the island from the continent;
4. The Dorcas gazelles of Tidra although completely isolated from the other populations belong to the same haplotype as the dorcas from the Malian Tamesna or from Sudan.

UPGMA tree of dorcas gazelle haplotypes for cytochrome b



The haplotype was similar to haplotypes found in dorcas gazelles from Algeria, Chad and the Sinai. This result is suggesting again that dorcas gazelles may be very uniform across the whole southern Sahara from the Atlantic to the Nile, with a hint that they may be partially isolated from those across the north.

4. FUTURE PROSPECTS

4.1. Monitoring of the population

This survey should be the beginning of a regular monitoring to better understand the functioning of this very peculiar Dorcas' population, totally isolated on a very small territory. Is it stable, increasing, decreasing? Is there a phenomenon of auto-limitation of its growth? If so, what are its mechanisms, internal (reduction of fertility, e.g.), external (predation, poaching)?

4.2 Further research

A wide range of other research questions is also open by this population wild but captive, among which, we could quote: genetics, feeding and behaviour studies, habitat carrying capacity, prey-predator relations,

4.3. Reintroduction from or in Tidra

At least, when the population functioning will be better understood, it could be considered to use Dorcas gazelles from Tidra to reintroduce on the continental part of the PNBA or even in other protected areas of Mauritania.

On the other hand, if it appeared that the limitation of the population size was due to loss of genetic diversity, it could be useful to reinforce the Tidra population with Dorcas coming from other countries of the sub-region.

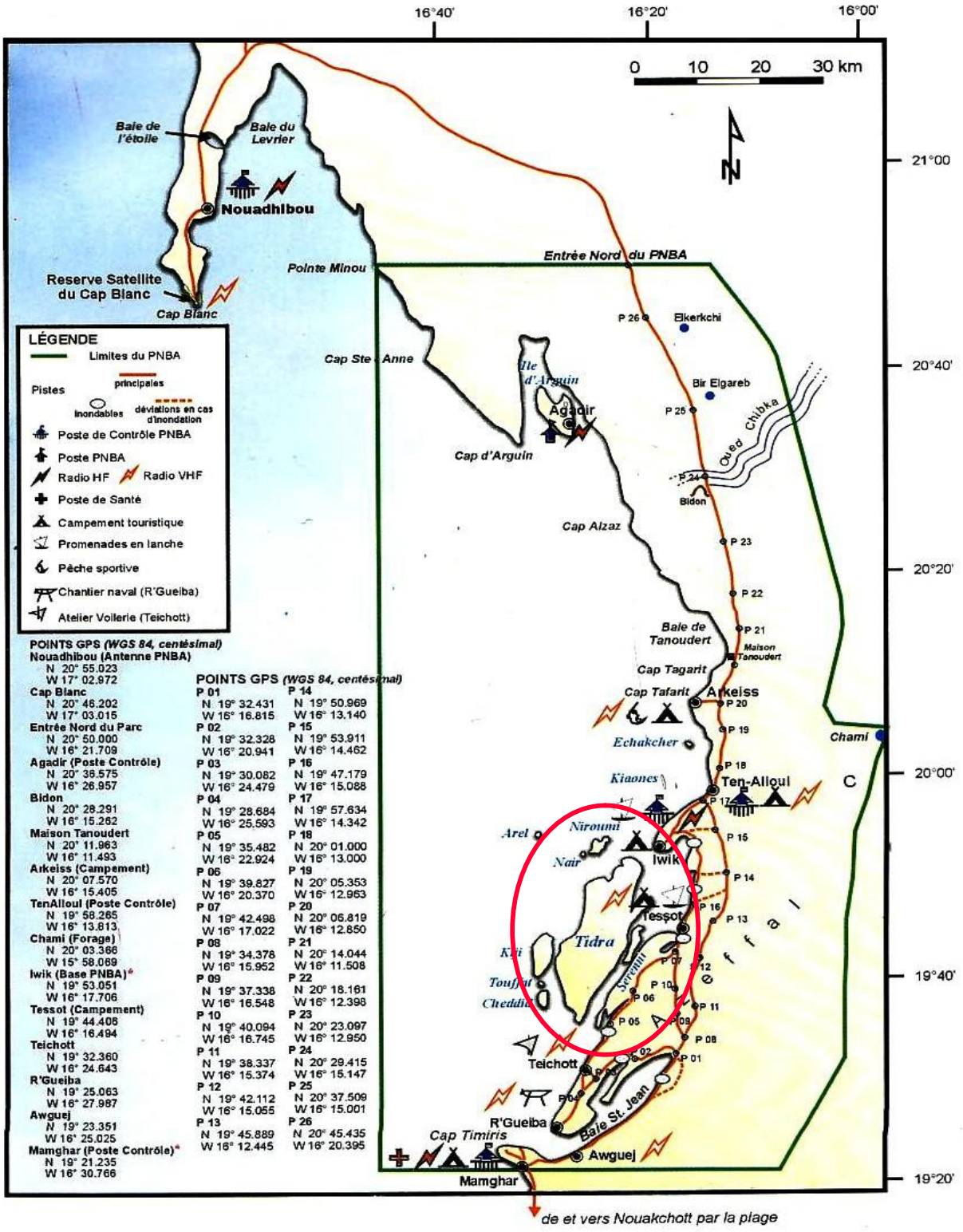
AKNOWLEDGEMENTS

This survey could not have been completed without the personal involvement of the PNBA staff and of the ONCFS' missionaries who carried out the field work.
Thus, thanked be here:

António Araújo, Abou Bakrine, Patrick Breuzard, Jean-Pierre Lafond, Louis-Gérard Martin d'Escrienne, Mohamed Ould Beyatt, Samba Simakha, Clément Wallerand and Mohamed Zamka.

Appendix E

Map 1: Localization of Tidra island



Studies on Scimitar-horned Oryx (*Oryx dammah*)
Tania Gilbert & Tim Woodfine

Introduction
Scimitar-horned oryx are extinct in the wild (IUCN, 2004), however the global zoo community holds a population of approximately 1500 in various institutions throughout the world. Most of these oryx are managed within four coordinated captive breeding programmes associated with the American Zoos and Aquarium Association (AZA), the European Association of Zoos and Aquaria (EAZA), the Japanese Association of Zoological Gardens and Aquaria (JAZGA) and the Australasian Regional Association of Zoological Parks and Aquaria (ARAZPA), with the two principle programmes being AZAs Species Survival Plan (SSP) and EAZA's European Endangered species Programme (EEP).

The captive population of scimitar-horned oryx provide an invaluable resource for research which can expand our knowledge of the species' biology, ecology, behaviour, morphology, husbandry and genetics. This in turn can help inform decisions for the *ex-situ* and *in-situ* conservation of the species and its return to the wild.

Currently there are three major studies on scimitar-horned oryx looking at their global genetic diversity, horn morphology and mortality. Additionally a number of smaller student projects have looked at the behaviour of oryx in the EEP.

Patterns of Genetic Diversity in Captive Populations of Scimitar-horned Oryx and its Implications for Management.
Arati Iyengar[1], Tania Gilbert[2], Tim Woodfine[2], Norman Maclean[1] & John Knowles[2]
[1]School of Biological Sciences, University of Southampton, Bassett Crescent East, University of Southampton, Southampton SO16 7PX, U.K.
[2]Marwell Preservation Trust, Colden Common, Winchester, Hampshire, SO21 1JH, U.K.

Introduction
Scimitar horned oryx (SHO) persisted in captivity after its extinction from the wild, with reliable records of founders dating back to the 1930s. Most of these founders are oryx captured in Chad in the 1960s, including three or four animals caught in 1963 and taken to the USA, and a much greater number that were captured by Van den Brink from an area of approximately 1200 km^2 over a two month period in 1967. Of these, ~26 were sent to North America, ~18 were sent to Europe and a few individuals were sent to zoos in South Africa and Tokyo (Rost A. personal communication).

The descendents of the North American and European animals are now managed within AZA's SSP, and EAZA's EEP programmes. The aims of the coordinated captive breeding programmes are to minimise the loss of genetic diversity and maintain appropriate demographic facets of each population. Programmes also aim to produce appropriate animals for reintroduction to the species' former range. Management decisions are based on pedigree data maintained in regional and international studbooks.

Sound genetic and demographic management of *ex situ* populations provides the basis for the viable preservation of a species in captivity and the ability to produce appropriate individuals, with the best possible genetic potential for reintroduction. We reviewed the management of captive scimitar-horned oryx and highlighted a number of issues that require management decisions that might be addressed through molecular genetic studies.

Despite being extinct in the wild, scimitar-horned oryx breed well in captivity and it is now one of the most commonly found antelope species in zoos across the world. There are approximately 380 and 450 individuals within the SSP and EEP respectively, which represent the most significant coordinated captive breeding programmes in terms of population sizes and numbers of founders. However, there is little information available about the founders. For the purposes of the studbook and pedigree analysis, it is assumed that the founders are unrelated. This was thought to be unlikely given that a majority were brought into captivity from a single capture operation in Chad and may therefore be, at best limited genetic representatives of the wild population, and at worst closely related individuals from a single herd. Moreover, throughout the history of the International Studbook, a proportion of individuals are recorded as 'of unknown parentage' because of the difficulties of identifying individuals in a herd, losses of individual identification markers and poor record keeping. Hence there is a need to validate our studbook analyses and to determine genetic diversity within and between the EEP and SSP populations. It is also important to identify any under-represented lineages within these populations.

It is possible that there are additional founders of the global captive population of SHO that are not represented in either the EEP or SSP, or indeed in any other coordinated captive breeding programme. If this is the case, there may be the opportunity to increase the founder representation in the formally managed programmes and hence increase current genetic diversity and potentially include valuable rare alleles. This would have benefits for both conservation breeding and reintroduction.

To date, few molecular genetic study has been carried out on the SHO. We are utilising both microsatellite genotyping and mitochondrial DNA sequencing. Microsatellite markers are often the marker of choice for such studies and have been widely applied to conservation genetics. Sequencing of the mitochondrial control region or D loop (a highly variable part of the mitochondrial DNA) will also provide information about genetic variation and the various maternal lineages represented. In fact, it has recently been reported that it is important to ensure high levels of genetic variability not only in the nuclear genomes of endangered species but also in mitochondrial genomes, since the effects of genetic drift are much greater for mtDNA than for a nuclear gene in the same population and since the mitochondrial genome is involved in some very important cellular functions (Allendorf, 2003).

Experimental methods and design

We have obtained 258 samples (largely faecal and some blood and skin) from a number of zoos from within Europe, North America, South Africa and Dubai. DNA was successfully extracted and amplified using polymerase chain reaction (PCR) protocols for 191 samples. The remaining 67 samples did not yield viable DNA. Nuclear DNA from the 191 samples was screened using six microsatellite loci (originally ten were identified, but four were unreliable). The mitochondrial D-loop region of 156 of the samples was then sequenced using a 1.2kb product. The remaining 35 samples yielded sequences of 300bp, however it was decided to eliminate these results from the analyses rather than increase the sample size, but decrease the length of the sequence (and thereby the accuracy of the results).

Resulting data was analysed using standard population genetics software such as Genepop, Bioedit, Genetix, Arlequin, Bottleneck, Cervus, DnaSP.

Results
Preliminary results reveal that high levels of heterozygosity have been retained by both the EEP and SSP populations; however the SSP has consistently revealed a higher level of genetic diversity than the EEP population.

There is both nuclear and mitochondrial genetic differentiation between samples from the EEP and SSP, with the EEP retaining one allele which is unique to the regional programme, but the SSP retaining eight. The frequency at which shared alleles occur within the EEP and SSP populations varies greatly, and without careful genetic management, there is a risk of losing some of the rarer alleles from the captive population.

The mitochondrial haplotype frequencies across the EEP and SSP reveal two distinct populations which diverged from each other some time ago, with few shared haplotypes (15 out of 19 haplotypes for the EEP are private, and 17 out of 20 for the SSP). Mitochondrial DNA analysis also reveals that population at the Dubai Desert Conservation Reserve has three distinct haplotypes not found within either the EEP or the SSP, indicating that there may be some oryx with alleles not represented within either of the major captive breeding programmes.

Further analyses are ongoing and will provide additional information on the genetic status of the species.

Conclusions
The high levels of heterozygosity observed are encouraging in terms of the genetic conservation of the species, with the mean allele numbers and heterozygosity levels comparable to those reported in the Arabian oryx (Marshall *et al.,* 1999). The clear distinction between the EEP and SSP programmes may have implications for the future management of the species within and between those two programmes, as could the identification of unrelated animals outside the EEP and SSP.

At the moment all results are preliminary and firm conclusions and recommendations cannot be reached until all analyses are completed.

Acknowledgements
Funding for this study was provided by Marwell Preservation Trust, the University of Southampton, John Speden Lewis Foundation, Ruth Smart Foundation, Sylvanus Chartitable Trust and the North of England Zoological Society. This research would not have been possible without the DNA samples provided by zoos, museums and individuals. Special thanks go to Alan Rost and Omaha Zoos who organised collection of the SSP samples.

Horn Morphology

Summary
Within the EEP population a number of oryx have developed asymmetric and deformed horns, with others loosing one or both horns through fighting, injury or deliberate removal by vets (due to deformities). This has resulted in a large variance in horn morphology between individual oryx within the EEP, and has begun to impact on the genetic and demographic management of the species as zoos reject breeding recommendations based on an animal's appearance, or its ability to be transported. It is also possible that fluctuating asymmetry in horn morphology may be an indicator of individual quality and impact on breeding success (Arcese, 1994; Moller et al., 1996). The consequences of variances in horn morphology may also have implications for the reintroduction of the species, in particular with regard to the selection and transport of animals,

and the ability of males to compete and adequately defend themselves and their young against natural predators.

This study aims to investigate the extent and causes of variances in horn morphology, evaluate fluctuating asymmetry in the European population of oryx and assess the true impact on the captive breeding programme and its implications for reintroduction programmes.

Fifty-four institutions which hold scimitar-horned oryx within the EEP have been sent questionnaires requesting horn measurements for individual oryx. To date 36 questionnaires have been completed and returned, with the details of an additional 19 museum specimens added to the database. This research is still within the initial stages and results will be presented once data collection has been completed.

Mortality

Genetic and demographic management of a population is considerably enhanced when the population is healthy and only suffers from the effects of old age. In reality, any population will lose animals from across the demographic range including those which are considered genetically important (due to them being descendants from under-represented founders), and those animals of optimum breeding age. Losing animals of either demographic or genetic importance risks the long-term stability of that population, and should be prevented if at all possible. This study aims to assess the causes of death within the EEP population and investigate whether any genetic, social or demographic characteristic influences the cause of death or lifespan of the captive population. This in turn may help to inform the management of the species and reduce the impact of mortality on the long-term viability of the European captive breeding programme.

All EAZA institutions within Europe which hold, or have held, scimitar-horned oryx within the last ten years have been contacted and post-mortem reports requested. Further mortality, demographic and genetic data has been extracted from the international studbook for 697 animals and inputted into a database in preparation for analysis. Results will be disseminated once data collection and analysis has been completed.

References

Arcese, P. (1994): Harem size and horn symmetry in oribi. *Animal Behaviour* **48**: 1485 – 1488.

IUCN (2004): 2004 IUCN red list of threatened species. www.redlist.org.

Marshall T.C., Sunnocks P., Spalton J.A., Greth A. & Pemberton J.M. (1999): Use of genetic data for conservation management: the case of the Arabian oryx. *Animal Conservation* 2; 269-278.

Moller, A.P., Cuervo, J.J., Soler, J.J. & Zamora-Munoz, C. (1996): Horn asymmetry and fitness in gemsbok *Oryx g. gazella*. *Behavioural Ecology* **7 (3):** 247 – 253.

Relations Between Wild Ungulates and Pastoralists in the Sahara: the Case of Teda-Daza and Beri People (Chad, Niger, Sudan)

Jérôme Tubiana

Abstract:

The Teda-Daza and Beri peoples mainly inhabit the Chadian Sahara, as well as parts of Niger and Libya (Teda-Daza), and the Sudan (Beri). I studied their relations with wildlife and the representation of wildlife in their cultures during 8 fieldtrips in the region (6 in Northern Chad, 1 in Eastern Niger and 1 in the Sudan).

The Teda-Daza and the Beri are essentially camel and goat herders. Thus wildlife has little role in their material daily life. Hunting products constitute a minor part of the food, and hunting is operated only by special groups of people, especially by the inferior blacksmiths cast. The Beri call sometimes wildlife “the outside thing”: they distinguish it precisely from cattle, which belong to the inside domestic world. But paradoxically it seems that wildlife has an unexpected cultural importance. Teda-Daza and Beri people have a global and precise knowledge of a basically useless wildlife. Wild animals are characters of oral literature, protectors of clans and supernatural beings playing a central role in pre-Islamic cults. However that extraordinary "wildlife culture" is disappearing under the pressure of two other cultures: Islam and, above all, Western modernity, that threatens both traditional culture and wildlife itself.

This wildlife culture could play a very positive role in any wildlife conservation project in this part of Sahara. Until now, local populations have been totally left out of the different projects. New projects, especially for the protection of the last populations of antelopes and gazelles, should absolutely take into account the unique cultural importance of these animals for the local populations.

Introduction

Since 1992, I had the opportunity to study ethnozoology among Teda-Daza and Beri pastoralists during 9 fieldtrips, 7 in Chad, 1 in Termit (Niger) and 1 in Northern Darfur (Sudan). This article is based in particular on 3 recent missions :

- September 2001. Participation to SSIG-CMS survey of Sahelo-Saharan ungulates in Northern Chad (Northern Kanem and Batha) dans le nord du Tchad (Nord-Kanem et Batha).
- October-November 2002. Zoological mission (in particular on addax *Addax nasomaculatus* and cheetah *Acynonyx jubatus*) of Paris Muséum national d’histoire naturelle (National Museum of Natural History), Institut de recherches pour le développement (IRD-Research Institute for Development) and Société zoologique de Paris (Paris Zoological Society) in Termit (Niger). This mission allowed me to complete the PhD study I began in Chad, in similar habitats, with the same fauna and ethnic groups.
- July-August 2003. Personal mission in the Ennedi massif (North-Eastern Chad).

When I began to work in this region, I was more interested in its fauna than its people. I first worked on oases ornithology, then on ungulates, in particular Barbary sheep *Ammotragus lervia* and addax. In 1995, I had a funding of the French Ministry of Environment to work in particular on the situation of Barbary sheep in the Ennedi massif. My car broke down at the beginning of the trip, but it gave me actually the chance to spend time among local populations, to travel like them with camels and to understand I could not well know the region’s fauna without its people.

I would probably have seen more animals driving quickly, everywhere, with my car, and, of course, a good local guide, but I would have certainly learn less on animals and their distribution if I had not spend time with various informers, some of them being real specialists of fauna or of one particular species. Some were able to tell the exact number and the sex of Barbary sheep surviving in isolated rocky hills, and what they said was later, when it was possible, checked on the field.

It convinced me there was work to do on this local knowledge, valuable for itself as well as for wildlife conservation.

The area on which I am working is situated in the Southern part of the Sahara and includes various habitats:

- Great plains of sand and stones (reg) constitute the most common habitat, in particular in North-Western Chad and Eastern Niger.
- Fixed dunes massifs, in particular Manga (on both sides of the Chad-Niger border).
- Mountain massifs constitute “islands” where rainfalls are more abundant. It is the case, in particular, of Ennedi, a sandstone massif around 1300 meters high, on which fall around 200 mm of rain each year, allowing relatively soft conditions at a Saharan latitude. It is also the case, but at a minor scale, of the Termit massif which, South of Tenéré desert, draws a line of scattered rocky hills only 700 meters high on 100 kilometres from North to South. There rainfalls are less than 200 mm a year, what clearly situates this massif in the Sahara.
- Steppic plains (Ayer, South of Termit, in Niger; Batha and Mortcha in Chad) are found in the South of the area. There rainfalls are more important than in the desert *stricto sensu*. Thus they are around 200 mm a year on Tasker village, in Ayer, 100 kms South-West of Termit massif.

Dunes and mountains of the area are among the last places where the fauna has survived in the Sahara. The best populations three of the six species of Sahelo-Saharan ungulates listed by the CMS – addax, dama gazelle *Gazella dama* and dorcas gazelle *Gazella dorcas*, are present in the area, which constitutes one of the last sanctuaries for two of them (addax and dama gazelle).

Two protected areas exist officially in the region, both in Chad:

- Wadi Rimé-Wadi Achim Reserve, created in 1969, on 80.000 km2, mostly in Batha, to protect populations of addax and oryx, *Oryx dammah*, then the most important numbers in the world.
- Fada-Archei Reserve, in Ennedi, only functioned briefly at the end of the 1960s.

These two protected still exist officially, but are actually unmanaged. In Niger, the protection of Termit massif has been planned as early as the 1950s, but never was realized, essentially for political reasons. However it seems it will soon materialize, thanks to the recent surveys in the area. Manga, on both sides of the Chad-Niger border, Wadi Rimé-Wadi Achim reserve and Ennedi could also benefit, later, of this impetus. However Niger is considered by the CMS as priority State, but Chad is not.

Ethnological Data

The area is inhabited by two ethnic groups.

1. The Teda-Daza, better known as the ”Tubu”, a name given by their neighbours Kanuri and Kanembu. Their territory is going from Termit massif in the West to Ennedi in the East.

   - The Teda are *stricto sensu* the inhabitants of Tibesti massif, in North-Western Chad. They are found in the Termit massif – where most of the Tibesti clans can be met – as well as in Manga and Ennedi, and North up to Libya.

   - Daza and Dazagada nomadize in large spaces between Niger and Chad – Ayer, Manga, Kanem, Djourab, Mortcha, Ennedi.

   - The Azza, or “blacksmiths”, traditionally constitute an inferior class: the whole handicraft, the music and hunting are reserved to them. Their most important groups are found in Niger and Western Chad.

2. The Beri, better known as Zaghawa and Bideyat, have sometimes been confused with the Tubu. They inhabit Ennedi and Mortcha, but their area is also including the Kabka massif in Chad and a big part of Northern Darfur in Sudan. They have too a blacksmiths’ caste – here called *may* – less important than the Azza.

South of the area are nomadic Arabs. They came from the North or the East during migrations since the Middle Age up to the 19th Century. West of Termit massif begins the large territory of the Tuareg. Termit was once part of it, but the Teda have been pushing the Tuareg a bit more to the West.

The Teda-Daza speak either Tedaga, or Dazaga, two very close languages, and the Beri speak Beri-a. These three languages belong – following Greenberg – to the Central Saharan group. The Azza speak Dazaga, but we know that the blacksmiths, among the Teda-Daza as well as among the Beri, often developed a specific dialect, especially not to be understood by their “masters”. I confirmed the existence of this dialect, called *Azzãnga* in Niger, and particularly present in the rich animal vocabulary of the Azza. It seems this dialect is now disappearing.

Presently, Teda-Daza and Beri are essentially camel and goat herders. Of course these activities can impact negatively wildlife distribution, but we do not want here only to determine the impact on local populations on wildlife, but, more than that, to question ourselves on the place of wildlife in their cultures.

Method

The fieldwork is basically divided into 2 phases :

1. Observations of the fauna and its habitats with the participation of the local population. Human presence is also recorded : wells and pools used by the people, nomadic or semi-nomadic habitations and domestic herds are documented.

2. Interviews with the local population.

Before any record of zoological and ethnozoological data among local populations, a classical ethnological investigation is made : identification of the populations, of their structure (clans),

their activities (pastoralism, hunting, etc.) and languages. This preliminary work gave the results we just summarized.

Interviews are made in local languages. Informers belong to various groups, in particular:

1. Traditional leaders,
2. Traditional blacksmiths-hunters. Hunting was once one of the main activities of the blacksmiths, and they are of course the best specialists of the fauna.
3. “Elders”,
4. Children: they are often in charge of watching the herds, and thus spend a lot of time in the nature, so that the have a good knowledge of the fauna and recent information on its distribution,
5. Teachers,
6. *Faki* or *mallom*: these Qoran teachers use some wild animals products as drugs and to make amulets.

During the observations as well as during the interviews, questions are asked on:

1. The distribution of the different species,
2. Local/traditional knowledge on the different species,
3. Hunting, hunted species, hunting methods, goals (meat, skin, destruction of predators, etc.), use of hunting products.

In a second part, the investigation is completed by using some anthropological « tools », useful for the ethnozoological as well as for the zoological research:

1. Vocabulary : the names of the different species in the local languages (Dazaga, Tedaga, Azzãnga, Beri-a, local Arabic as well as Tamacheq in Niger) are recorded systematically, during direct observations of the animals or using photographs. We use a precise transcription system, based on former linguistic and ethnological works. During the interviews, I use systematically the names of the different species in the local languages and I checked and eventually increased my knowledge on the animal vocabularies in these languages. All in all, 241 names of animals have been recorded in Dazaga, 234 in Beri-a and 143 in Tedaga – this smaller number can be explained by the more Saharan situation of the Teda and their weaker knowledge of the Sahel fauna -, as well as around 100 in Azzãnga.

2. Oral literature concerning wildlife is recorded in a local language, then translated into French with a good translator. All in all, some 140 tales, clan myths and songs related to animals have been recorded.

3. All customs and beliefs concerning wildlife are documented. This includes in particular the fact that it is forbidden to kill and eat some animals : while investigating on hunting, it is important to know which animals our informers can kill/eat, which ones they can not, and the reasons why – religious beliefs, clan totems, etc. I also documented medicinal, magical or religious customs related to wildlife.

Results

1. Presence of Sahelo-Saharan Ungulates

The **oryx**, the biggest species known in the area, is probably already extinct. On the field, In Chad as well as in Niger, almost all the informers have tell they have not seen any oryx for at least 20 years. Some spoke about oryx surviving in isolated areas, but either we were not able to find any evidence of it, or we had an evidence they were confusing oryx and the other big Saharan antelope, addax – which confirms they had probably not seen any oryx for a long time.

Missions of 2001 and 2002 revealed the survival of small populations of **addax** in Chad and Niger, the last one probably being the most important population of the species. One of the problems addax is facing is the competition with the camels, which take the best pastures.

These two missions also revealed the presence of small populations of **dama gazelles** in Chad as well as in Niger. Small numbers of dama gazelles can probably be found on a narrow strip going from Termit massif, in Niger, to the Chad-Sudan border.

Relatively important numbers of **dorcas gazelles** remain, more in Chad than in Niger. In the two countries, they resist intense hunting.

2. Impact of Human Activities

Pastoralism

All water resources (wells, temporary pools) met have been recorded, and information on other water resources have been gathered during interviews. All nomadic camps met have been recorded. Camels, goats, sheep, have been numbered by view. Such a counting can not be perfect, but it is not possible to get viable data on this subject from the administration, neither from the nomads themselves, because these ones deliberately hide the importance of their herds – they could be afraid, in particular, to be taxed on this basis.

Thus data on populations and cattle distribution have to be used with prudence. More, this distribution is changing a lot following seasons and years – rainy or not. After the rainy season (July-August), nomads look for fresh pastures, whose distribution change from year to year, rains being sometimes concentrated on very limited areas, as we observed again during 2003 rainy season on the Ennedi massif. Some areas (Mortcha, Batha, Ayer and the plain West of Termit massif) are, after the rains, relatively rich in pastures. Many camels are also, from May to October following places, moving in caravans to various oases, where nomads look for dates and salt. More, it is not so easy to evaluate how long last a camp and how long the cattle stay in an area, and thus the real impact of man on the ecosystem.

Data recorded after the rainy season show, of course, that the cattle, together with human populations, concentrate where are found the best pastures and water resources at this time of the year:

1. North of Dar Zaghawa (in Chad and Sudan) : in the Mortcha in Chad, along Wadi Howar (Chad-Sudan border) and up to Bir Atrun and Nukheila oases in Northern Darfur. Pastures found immediately at the foot of Ennedi massif and on the plateaux are conserved for the dry season, because of the important permanent water resources (*guelta*) present in the area.

2. In the Mourdi (Chad).

3. In Batha and Manga (Chad).

4. In Ayer, at the Southern extremity of Termit massif and on its Western limit, in Niger.

Other areas (Ennedi and Termit massifs, Djourab, Eguei, Bodele, Tenere) seem to be, after the rainy season, left for wildlife, which numbers are more important there. However it is still possible to observe in some places wild animals (in particular dorcas gazelles) very close to the cattle.

Hunting

As local populations are essentially pastoralists, hunting is not essential in their food, and it was not much more at a time when the fauna had bigger numbers. The Teda-Daza and the Beri eat:

1. Cultivated cereals, mostly millet, bought on the markets where they sell cattle; wild cereals (*kreb* in Arabic); dates.

2. Pastoralism products : milk and butter from camels and goats, and meat, mostly goat. Camel meat or, in the Southern part of the area, beef, is rarely eaten : these animals are essentially milk producers, and a capital to exchange, in particular during weddings.

Only particular categories of the population hunt:

1. Blacksmiths, or *Azza*. The whole handicraft, and hunting, in particular with traps and nets, are reserved to them. These activities are not well seen by the rest of the population, while – traditionally – pastoralism is forbidden to the Azza. Today Azza live in good numbers in Ayer, South of Termit massif, as well as in Northern Kanem. They were travelling in the past – fifty years ago – more arid areas, like Northern Manga in Chad or Termit massif in Niger, in particular for hunting. The reason of their absence of these areas today, following Azza themselves as well as non-blacksmiths – is that the Teda now forbid the Azza, if necessary by force, to hunt there.

2. The culture of the blacksmiths-hunters is slowly disappearing, together with the traditional hunting, because of the disappearance of the fauna itself, but also of the social dynamics: to escape their inferior condition, the blacksmiths give up traditional activities and become pastoralists, but also teachers, soldiers, etc. I observed this phenomenon in North-Western Chad as well as in Niger.

3. Children. While watching the cattle, they hunt small game. This activity, and the food resulting of it, are not suitable for an adult.

4. Nomads have very often guns and sometimes try to hunt animals (in particular dorcas gazelles) met on their ways. It seems non-blacksmiths Teda-Daza and Beri hunt today more than in the past, using guns, and thus are in competition with traditional blacksmiths-hunters.

5. Pastoralists also hunt, in particular with traps, predators threatening the cattle.

6. Owners of four-wheel-drive vehicles, in particular militaries, hunt any game met on their way. These vehicles, with the guns, are certainly the first cause of the disappearance of big ungulates in the Sahara.

If we have been able to get easily information on traditional hunting from Azza “professional” hunters, other interviewed people certainly minimize the importance of hunting with guns. They are afraid of an eventual repression from authorities, and militaries rarely talk about hunting, though they clearly hunt. Often non-blacksmiths hold blacksmiths as responsible of the disappearance of the fauna, which is actually unfair. In Chad, some speak about “the events”, as is called the succession of wars of the 70s and 80s, and the hunting pressure still exercised by the militaries. Many mention also another cause for the fauna’s disappearance: the big droughts of the same period.

Local people also believe that the great mammals are not extinct, but “gone” somewhere else. In Niger, it is often told they have been to Chad, while in Chad it is sincerely believed they have been to Niger, and even the C.A.R. This myth allow also to hide the part of responsibility of local people in the disappearance of the fauna.

3. Sahelo-Saharan Ungulates and Teda-Daza and Beri Culture

Addax (*Addax nasomaculatus*)
Addax, a white antelope able to survive in the most desert conditions, is essentially for the Teda-Daza and the Beri, a game, an object of hunting. Is has a less important place in Teda-Daza and Beri cultures than other species, including other ungulates. Addax is present in oral literature, but only in songs, which are all blacksmiths-hunters songs. I recorded two songs on addax, as well as two on oryx, but none on dama and dorcas gazelles. However, neither addax nor oryx are present in tales, while dorcas and dama gazelles are. More, addax is not a totem for any clan, as opposed to dama and dorcas gazelles or Barbary sheep (*Ammotragus lervia*). However its horn can be used for amulets, as well as the skin of the young addax, which is supposed to bring success in court. Apart these para-religious beliefs, addax is absent from supernatural reign, and limited to the cultural world of traditional hunting. It is essentially a game hunted for its meat, and it is clear, in Chad as in Niger, that traditional hunting took part in the decline of its populations. Nevertheless, it does not mean that Azza hunters do not have the consciousness of this decline: they can participate to preservation projects and will probably be more motivated than non-traditional hunters (like the militaries).

Oryx (*Oryx dammah*)
The place of oryx is very similar to the one of addax: it is essentially a game. I recorded two hunting songs on it, no tale, and no clan totem. I did not find any medical, magic or religious use, but is may be related to the disappearance of the species.

Dama gazelle (*Gazella dama*)
Dama gazelle does not seem very important in the Beri culture, but its place in the Teda-Daza culture is more important than the ones of addax and oryx, and very different. I did not record any hunter song on this species, but it is a character of Teda-Daza tales, however less common than other species, in particular dorcas gazelle. It is mostly the totem of two Teda clans (Musoa and Gezisa), of two Azza clans and one Azza sib-clan (Bogorda, Aosa et Trõndo Magi).

Dorcas gazelle (*Gazella dorcas*)
Dorcas gazelle, which South of the area can be confused with red-fronted gazelle (*Gazella rufifrons*), is a common animal in Teda-Daza and Beri tales. It is a weak sometimes clever character. It is the totem of Tebya (or Makala), a Dazagada clan of Beri origin. The picture of its footprint is a camel mark, known by its Dazagada name of *widentigi*, the "gazelle's foot" It does not seem it is, as Kronenberg[2] said, Teda Huktya's totem, though *widentigi* is their camels mark. This mark is also found through other Teda-Daza clans, and then called *gurtidinga.* Dorcas gazelle may be used in amulets: the skin of a young dorcas caught asleep – which is not so easy – is supposed to protect from guns. Though it has a mostly positive value Teda-Daza and Beri people, dorcas gazelle does not necessary bring good luck: thus for the Beri, meeting a dorcas gazelle coming from the left is of bad luck, but the same animal coming from the right will be seen as a happy sign.

In the tales, gazelles may be explicitly genies, like the one-eyed – a genie's character – of one Beri tale[3]. Another Beri tale[4] describes the gazelles as the goats of the genies, establishing a relation between the wild world and the pastoral world – a very important separation in the culture of Teda-Daza and Beri pastoralists. Thus we can see that dorcas gazelle belongs, even more than dama gazelle, to a wild nature which is related to the supernatural world.

Some hunters, including "modern" hunters with vehicles, say they only hunt male gazelles. The explanation that was given to me is that males are easier to hunt, but it is possible to see there a tradition whose aim would be to limit hunting damages.

4. Representation of Wildlife

On the whole wildlife, we can observe, in spite of the weak place of wild animals in the material life of the pastoralists, an unexpected, and even paradoxical, importance of the wild fauna in the local cultures. In Dazaga, Tedaga and Beri-a, and of course in the dialect of Azza hunters, there is a rich and precise animal vocabulary, testifying a global and precise knowledge of wildlife. Interviews also show that local populations hold an important knowledge on animals, their habitats, the evolution of their populations and their behaviours. This knowledge is essential for who wants to study or protect the fauna of these areas, as show the validation of the data recorded during the interviews by observations on the field.

More, wildlife has an important place in the Teda-Daza and the Beri culture, especially in their oral literature. Actually the most striking fact is not so much that the wild animals are present in the tales – it is the case everywhere in the world – but that the domestic animals are absent of the tales, though we are among pastoralists. The main characters of the tales are indeed the jackal (*Canis aureus*), the ground squirrel (*Xerus erythropus*) and the hare (*Lepus capensis*), animals seen as « clever ». The songs, especially the ones of Azza hunters, speak of species present as well in the tales, like the jackal, the striped hyaena and the lion, but also of others, like addax and oryx, mostly related to the specific culture of the hunters. Tales and songs give us information on the fauna itself as well as on its representation by Teda-Daza and Beri people. We can see that even the predators of the herds are not systematically seen as enemies.

[2] Kronenberg, Andreas. *Die Teda von Tibesti.* Vienna, Berger Horn, 1958, p. 65.
[3] Tubiana, Marie-José and Joseph. *Contes Zaghawa.* Paris, Quatre-Jeudis, 1962, p. 187-189.
[4] Tubiana, Marie-José et Joseph. *Contes zaghawa* (*op. cit.*), "Tédi-Kidi", p. 86-87.

Even more specific is the presence of totemic animals. Indeed Teda-Daza and Beri people are divided into various clans, these clans often have totems, and these totems often are wild animals. Thus the members of a clan with an animal totem must not kill and eat the meat of their animal, and show respect for it. The clan identity is based not only on a common ancestor, but also on these totems, often animals who have, in a remote past, given protection to the ancestor. All in all, I found 34 totemic animals, including 13 mammals – dama and dorcas gazelles, but also giraffe (*Giraffa camelopardalis*), kudu (*Tragelaphus strepsiceros*), tiang (*Damaliscus lunatus*), Barbary sheep (*Ammotragus lervia*), rock hyrax (*Procavia capensis*), orycterope (*Orycteropus afer*), ground squirrel (*Xerus erythropus*), spotted hyaena (*Crocuta crocuta*), lion (*Panthera leo*), patas (*Erythrocebus patas*) -, 8 birds – including the ostrich (*Struthio camelus*), Egyptian vulture (*Neophron percnopterus*), bustard and raven -, 8 reptiles – including the snake, desert monitor (*Varanus griseus*), uromastyx (*Uromastyx acanthinurus*), skink, chameleon and tortoise (*Testudo sulcata*) -, as well as 4 insects. Some other species are preserved by beliefs concerning the whole populations, and related to pre-Islamic cults. As some hunters do not hunt female dorcas gazelles, Teda-Daza and Beri people believe it is bad to kill female Barbary sheep, as well as to kill more than one Barbary sheep in the same time, because Barbary sheep are seen as belonging to genies. Some Teda-Daza also respect foxes, including the fennec, because they see them as genies themselves.

Conclusion

I mentioned in the beginning of this article one of my first journeys in Ennedi, a first mission on ungulates in 1995. The data I brought back on addax and oryx were already very pessimistic. But the results on Barbary sheep, mixing observations and investigation among local populations, were more optimistic. They were actually in contradiction with the mostly pessimistic information brought by the Europeans, including hunters, travelling in the area, but who did not work with the local population. As often, Western knowledge and data coming from the local knowledge were not the same.

“Many Westerners do not see traditional knowledge as a science. Scientists come only one week a year and come to conclusions without taking into account the knowledge we accumulated when living everyday with the animals.” The man who told me this could be a Sahara nomad, but he is an Inuit, Ben Kovic, the president of the Wildlife Management Board of Nunavut, the new autonomous State of the Inuit in the Canadian federation. In this State, traditional knowledge and observations of local people on wildlife, its importance and its distribution have been recently recognized, so that some hunting quotas, in particular concerning some species of whales, have been revised.[5] Thus this recognition has an immediate interest for the Inuit, but also an interest for science.

In Canada, native people have now specific rights on nature, as native but also, more pragmatically, to answer to their food needs. It provoked conflicts with another part of the Canadian population having a more conservationist vision, the kind of vision that was probably mine when I began to work on environmental issues. Even before to work on Barbary sheep in Ennedi, I had spent one month in Canada among Innu (Montagnais) Indians of the Northern Coast of the Gulf of Saint-Lawrence. They were spending much time to hunt, and with guns, what did not satisfy my preconceived ideas on American-Indian culture, but after conflictual moments, I understood that, be it with guns, they needed to hunt, did not waste and conserved a true relation to nature, though it was not immediately visible.

[5] Tubiana, Jérôme. Les écolos du Grand Nord : *Le Point* n° 1560, 9 août 2002.

Afterwards, I made similar observations on Teda-Daza and Beri people. Of course we should be careful not to make unrealistic comparisons: Sahara pastoralists are not, or not much, hunters. The how to explain this “culture of nature”, going far beyond a simple knowledge on the number or distribution of animal populations? Of course, they depend on their environment. But essentially on pastures, water, and indirectly predators. The material life can not explain everything, and the true explanation is probably to look for in the culture itself.

Today this specific culture of wildlife is disappearing because of Islam, but also of the pressure of modernity, responsible of the disappearance of traditional customs as well as the Saharan fauna itself. This wildlife culture could play a very positive role in any wildlife conservation or reintroduction project. Local knowledge, beliefs and customs including respect for a number of species can be useful.

It is common today, in particular since Rio Conference on Biodiversity in 1992, to consider that local populations have to participate to the conservation of their environment – it is the meaning of article 8.j. of the Convention on Biodiversity. In Africa, nature conservation is generally coming from the colonial system: like the colonial State, the independent State, supported by international partners replacing in a way the colonial powers, is taking possession of nature while conserving it. Limited in some areas and for some species, hunting is generally permitted elsewhere, and some species not hunted by local people are then considered as game. This dispossession is completed by an appropriation of the land itself, through the modern land laws of African States, in contradiction with the traditional laws – this last one still being used, *de facto* if no *de jure*, on many areas. The idea of the nature as a « world heritage » is actually continuing with a more modern appearance this dispossession of local populations. On the contrary, Rio is retransforming nature into a local heritage, an idea corresponding well to Teda-Daza and Beri conceptions: for them, the responsible of nature – and of its fertility – is first the traditional power, traditional leaders being also landlords. The totemic species are in a way out of the land rights and seem to belong anywhere to the related clans.

Now, more than ten years after Rio, how to use this proposed re-empowerment of the local populations? In the area we are talking about, up to now, it did not go beyond words. From the colonial era, nature conservationists have only looked at the negative impacts of local populations on the fauna (hunting, overgrazing). More recently it was tried to find compromises between protection and human activities, eventually to promote activities which do not have any impact on wildlife. Sometimes, we try to give local populations economical reasons to protect the fauna, in particular tourism or eco-tourism. All that seems to be part of a Western model of economical development, and even if it is now called “sustainable development“, it remains strongly in opposition with local cultures.

Up to now, Teda-Daza and Beri people have been totally left out of the projects of conservation. Still today, the conception of such projects is made by Western experts, not in partnership with local populations but with the administration, which has many handicaps: it has few financial and human means, it is distant, and its authority is not recognized by the Teda-Daza and the Beri.

Actually, there is in the Rio Convention a major contradiction: while asserting the role of local populations, it can not go oppose the States. However the acknowledgement of the local populations originated from the fact that, in many Southern countries, they were in conflict with the State. This situation remains very clear in the former French colonies, partly because of the transposition there of the French centralized system. This conflict has been worsened, in the Saharan States, by the fact that the power, immediately after independence, fell in the hands of

non-Saharan groups having, with the desert populations, relations of reciprocal disdain. Niger is still in the situation which caused the Touareg and Toubou (Teda-Daza) rebellions in the 1990s. In Chad, this situation was evident before 1979, when Saharan populations felt dominated by the independent State, and joined rebellions in the 1960s and 1970s.

These conflicts are also worsened by clear cultural factors: the taste for freedom of Teda-Daza and Beri people is famous and even traditional leadership is very diluted; they do not feel part of any State, all the more they have been cut into two or three by the colonial boundaries. Even when Teda-Daza and Beri people are holding the power - what has been in Chad since 1979 for, successively, the Teda, the Daza and the Beri -, conflicts between them and the State remain strong. For instance in the case of Chadian Beri, though a part of them is controlling the State since 1990, another one began, almost automatically, a rebellion. More, the whole group in power keeps, in its region, a strong autonomy.

These situations of gap between a State and local populations can easily handicap projects based on a partnership between Southern States and Northern States, international organizations or NGOs, forgetting local populations.

New projects are on track, especially for the protection of the last populations of antelopes and gazelles. The Termit massif and some of the surrounding areas could become a protected area in the future. But it will not be sufficient to create this protected area to save the fauna, and without this protected area, the fauna will not necessarily disappear. Be they protected areas or other solutions, it seems fundamental that the projects take into account the importance of wildlife in the local culture.

Actions of sensitization linking wildlife and local cultures could be useful, to show that to protect animals is not only a Western concept, but can also benefit to the preservation of local cultures. And while sensitizing local populations to the preservation of wildlife, we should also sensitize nature conservationists to local cultures. Wildlife conservation should not be conceived only from the point of view of Western science, but as well from the one of the pre-existing local culture. Anyway it will be very difficult to protect one without the other.

Acknowledgements

Acknowledgements to IGF-Fondation internationale pour la sauvegarde de la faune and Société d'encouragement pour la conservation des animaux sauvages (SECAS).

Bibliography

D'Arbaumont, Jean. *Le Tibesti et le domaine téda-daza*, Centre d'études sur l'histoire du Sahara, Paris, 1989.

Baroin, Catherine. Les marques de bétail chez les Daza et les Azza du Niger*, Etudes nigériennes* n° 29, Niamey, 1972.

Chapelle, Jean. *Nomades noirs du Sahara*, Plon, Paris, 1957 ; 2nd ed. L'Harmattan, Paris, 1982.

Claro, Françoise, Sissler, Céline & Tubiana, Jérôme. *Rapport de mission scientifique au Niger dans la région de Termit.* IRD (Institut de recherches pour le développement), Muséum national d'histoire naturelle et Société zoologique de Paris, rapport non publié, 2003.

Dragesco-Joffé, Alain. *La vie sauvage au Sahara*, Delachaux et Niestlé, Neuchâtel-Paris, 1993.

Le Berre, Michel. *Faune du Sahara* (vol. 1 : *Poissons, amphibiens, reptiles,* vol. 2 : *Mammifères*)*,* Lechevalier - R. Chabaud, Paris, 1989.

Sahelo-Saharan Interest Group (SSIG-Groupe d'interêt sahélo-saharien). *Inventaires de la faune sahélo-saharienne*, 1e partie : Tchad occidental et central (septembre-octobre 2001), 2e partie : Niger (février 2002), Zoological Society of London (ZSL), 2003.

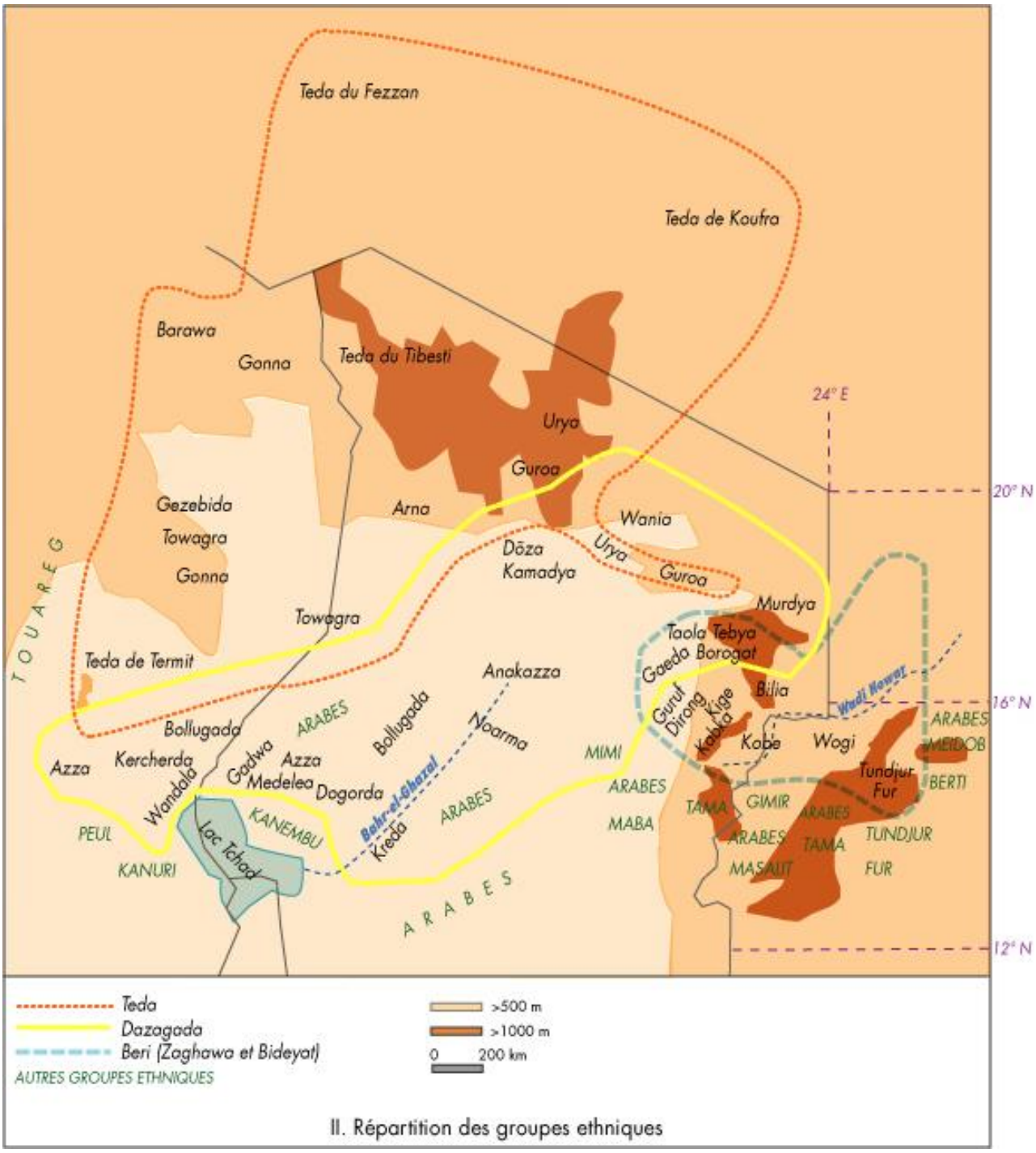
Tubiana, Jérôme. L'islam et la nature chez les éleveurs du nord-est du Tchad (Teda-Daza et Bèri) : *Le Saharien*, 2000, n° 153, 154 et 155.

- *Représentation de l'animal sauvage chez les éleveurs (Teda-Daza et Bèri) du nord-est du Tchad,* mémoire de DEA, Institut national des langues et civilisations orientales (INALCO), 2000.
- Gazelles du Sahara, la grâce piétinée : *Terre sauvage*, 182, avril 2003, p. 64-67.
- Relations entre faune sauvage et éleveurs au Sahara : le cas des Teda-Daza du massif de Termit et de l'Ayer (est du Niger) : Communication au séminaire de Parakou (Bénin) « Aires protégées en Afrique de l'Ouest », IRD (Institut de recherches pour le développement)-Université d'Abomey-Calavi, 2003.

Tubiana, Marie-José & Joseph. *Contes Zaghawa*. Paris, Quatre-Jeudis, 1962.

Tubiana, Marie-José. Interdits de clans et animaux chez les Zaghawa du Tchad et du Soudan : *L'homme et l'animal, 1er colloque d'ethnozoologie*, Paris, 1975.

Wacher, Newby, Monfort, Tubiana, Djadou Moksia, Houston, William & Dixon. Sahelo-Saharan Interest Group Antelope Update Chad 2001 and Niger 2002 : Chardonnet, Bertrand et Philippe (ed.). *Antelope Survey Update,* n° 9, IUCN/SSC Antelope Specialist Group Report, Paris, Fondation internationale pour la sauvegarde de la faune, November 2004, p. 52-59.



II. Répartition des groupes ethniques

The Re-Introduction of Scimitar-Horned Oryx, *Oryx dammah,* and Dama Gazelle, *Gazella dama mhorr* to Ferlo, Senegal: Two Years After

Abdelkader Jebali

Abstract:

The re-introduction of the scimitar-horned oryx (*Oryx dammah)* and Dama gazelle (*Gazella dama mhorr)* in the Ferlo-North Faunal Reserve (FNFR) in Senegal began in January 2003.
The case of both antelopes is particular because of their singular status. Both are considered extinct in the wild. The first species disappeared from Senegal in 1850 and the latter was seen for the last time by the beginning of the 1970's.

This operation is one of the rehabilitation programmes of Sahelo-Saharan ungulates that once roamed the Sahelian part of Senegal. The animals transfer took place in two stages. 8 oryx and 9 Dama gazelles were relocated to the FNFR from the Gueumbeul Special Faunal Reserve (GSFR). Only Dama gazelles suffered from the relocation which proved that the transfer conditions were inadequate for this particular species. An almost 50% dead.

By March 2005, oryx and gazelles seemed to be in a satisfactory welfare and were completely sustained by the native vegetation of the Reserve.

The number of the oryx increases to 18 individuals but that of gazelles does not show a truly change. Only one birth was registered.

INTRODUCTION

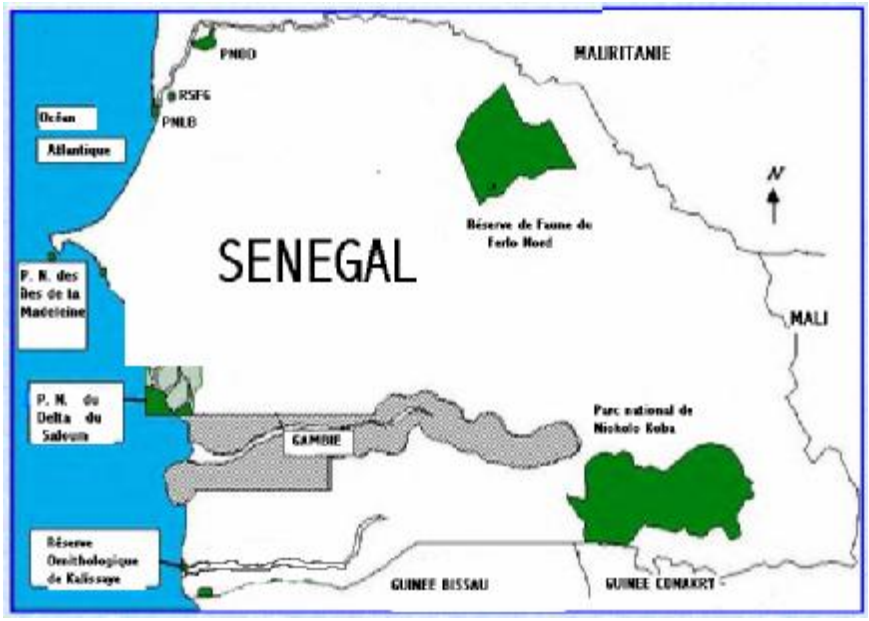
The re-introduction operation was motivated by the desire of the Senegalese Department of National Parks (DPN) to repopulate the Ferlo Reserve with its native wildlife. The latter suffered a serious decline since the fifties. The antelopes in question disappeared from Senegal several decades ago (Devilliers & Devilliers-Terschuren, 1999a, b ; IUCN, 2002).

The case of scimitar-horned oryx and dama gazelles of the *G. d. mhorr* subspecies is special insofar as where these taxa are considered extinct in the wild (Devilliers & Devilliers-Terschuren, 1999a, b ; IUCN, 2002). And this is where their interest in this re-establishment operation comes from.

PRESENTATION OF THE FERLO-NORTH FAUNAL RESERVE (FNFR).

The Ferlo-North Wildlife Reserve was created on 21 May 1972 to preserve the wildlife of the Sahel in Northern Senegal. It extends over 487,000 ha and as a result represents the second Senegalese protected area run by the DPN after the Niokolo-Koba.

It is located in the north-east of Senegal in a Sahelian region much influenced by its continental position. Human presence was impossible during the dry season because of the almost total disappearance of any permanent watering place. Consequently, the region was designated as "desert" on ancient maps (Vallier, 1906, Roure, 1956). The presence of nomadic Peulh herders was recorded only during rainy seasons. However, this balance which allowed a certain amount of prosperity for wildlife was destroyed with the coming of drilling for half the 20th century.



In Ferlo, the temperatures are high all year. The winds of "Harmattan" rage across the plains for days from January to May (DEFCCS, 1999).

May is considered the hottest month of the year with a mean temperature of 35°C (95°F) with maximum temperatures above 40°C (~105°F). January is generally the coolest month with a mean temperature around 25°C (~75°F) with minimum temperatures that can get as low as 16°C (60°F).

Rainfall varies between 200 and 500 mm (~8 and 20 in.) (DEFCCS, 1999) distributed over 32 days on average (n= 13 years). During the year 2000, Ranérou station, in the interior of the Reserve, recorded 626.9 mm (~25 in.) and in 2003, more than 800 mm (30 in.) of rainfall was recorded.

Vegetation hit by several years of drought during the seventies and eighties is now confronted with increased over-pasturage. Wooded and shrubby sections are dominated by *Acacia seyal, A. senegal*, *Dalbergia melanoxylon*, *Balanites aegyptica*, *Ziziphus mauritiana*, *Boscia senegalensis*, *Adansonia digitata* and in the extreme north of the reserve there is an *Acacia raddiana* steppe.

Grassy sections are essentially composed of *Schoenefeldia gracilis*, *Cenchrus biflorus*, *Dactyloctenium aegyptium* and *Zornia glochidiata.* This section is totally absent during the dry season. So, human pressure, represented above all by herds of domestic livestock, is very important.

The fenced reintroduction enclosure alone shows good grass coverage, which contrasts with the desolated views outside and may give an idea of the species present in the reserve before it was put to pasture.

When the reintroduction operation of 2003 took place, there were still in the Ferlo North Faunal Reserve some residual herds of Red-fronted gazelle (*Gazella rufifrons*), red-necked ostriches (*Struthio camelus camelus*) and warthogs present. On the reptile side, one could still find

Sulcata tortoises (*Geochelone sulcata*) and Savannah Monitors. Bird life remained relatively rich and varied even though guinea fowl and bustards have suffered greatly from poaching.

The human presence is palpable. It is concentrated around boreholes that play a determining role in the current appearance of Ferlo (Tersiguel and Becker, 1997, Barral, 1982).

THE REINTRODUCTION OPERATION

History:

The reintroduction of dama gazelle (*Gazella dama mhorr*) and scimitar-horned oryx (*Oryx dammah*) in Senegal took place respectively in 1984 and 1999 in the Gueumbeul Special Wildlife Reserve (Dupuy, 1984 ; Cano & al, 1993 ; Manding, 2000 ; M'Bodj, 2002 ; DPN, 2003, Jebali, 2003 ; Gilbert, 2004). The transfer to the Ferlo North reserve took place during January 2003. It was done in two trips and involved 8 (2.6) oryx and 9 (2.7) dama gazelles. Unfortunately 4 female gazelles perished during this transfer. The operation is described in detail elsewhere (Jebali, 2003).

The animals were placed in an acclimatization enclosure for two months then released into the greater reintroduction enclosure which covers almost 600 ha. The latter is situated at the termination of one of the many tributaries to the ancient Ferlo river. The enclosure, whose fencing was put up in 2001 to protect the vegetation and, later, the antelopes, against the straying of domestic animals. In 2003, regeneration of the ground cover was already remarkable. The antelopes who had already tried out certain species in the Gueumbeul Reserve, did not apparently find much difficult in acclimatizing themselves to the local flora.

Current State (March 2005) :

The reintroduction enclosure : thanks to the fencing off, the vegetation continues to gain in vigour and provides for the reintroduced antelopes' needs all year long. Several *Acacia seyal* and *Zizyphus mauritima* tree saplings have been noticed within the compound, something that does not exist in its surroundings. Some clumps of *Calotropice procera*, a very desirable species for dama gazelles, have come up a little all over. The grassy layer is well grown and continues during the dry season. Moreover, in the context of supporting the local population, Reserve officials allowed a certain number of people to enter into the enclosure each day to reap hay for their animals at the end of the dry season. In June 2004, 10 carts on average went into the enclosure to reap. The same number of women are tolerated to collect *Cassia tora* stalks used for the maintenance of huts before the monsoon. These uses do not seem to have affected provisions for antelopes and the myriad other species such as warthogs, hares and the numerous other rodents, as well as termites.

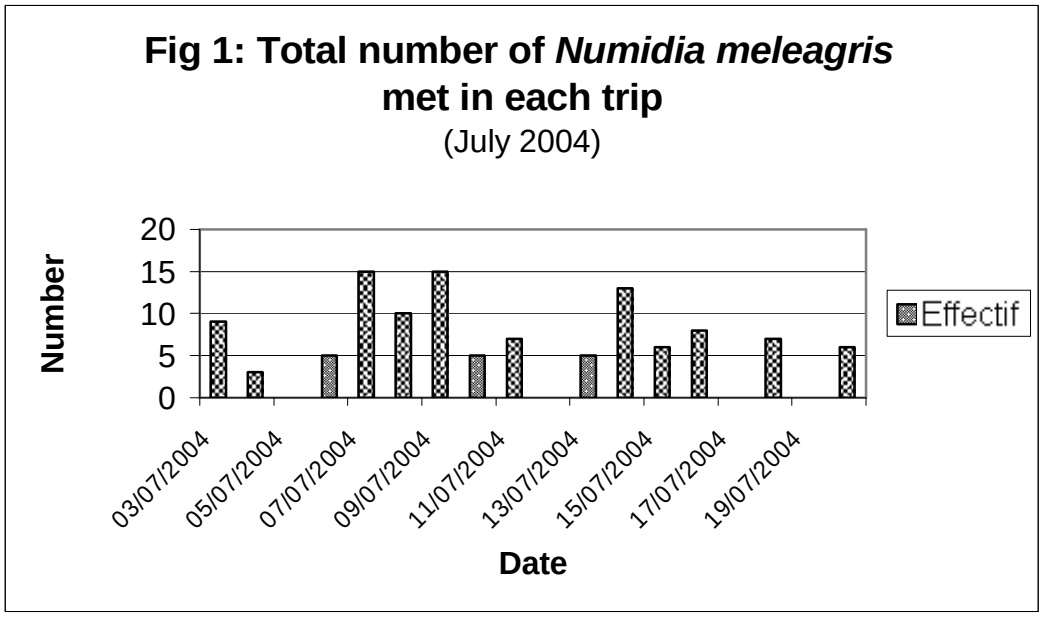
Outside the enclosure, grasses are hardly to be found during the dry season. It is this that gives a desolate aspect to the savanna in the surrounding area.

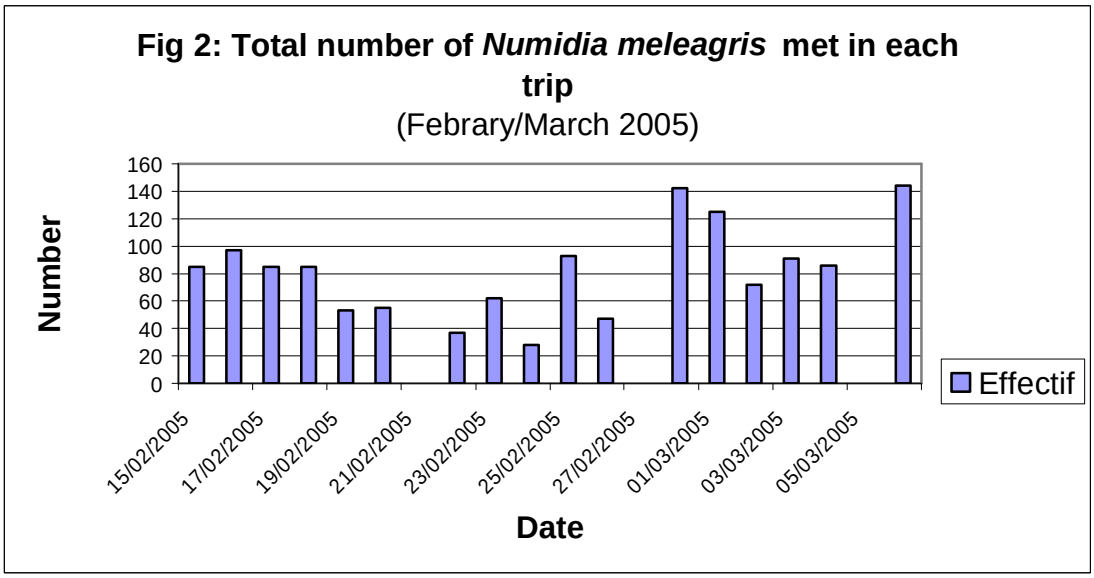
The increase in the variety of bird life is noticeable. In addition to the presence of bustards, the number of guinea fowl has grown in record time (figs. 1 and 2).

In 2003, only a few rare specimens were noted in the north-east of the enclosure. In 2004, an eruption of species was recorded within the protected area. Flocks were composed of from 1 to 7 individuals and the total maximum number that anyone has been able to record per trip was 15. In March 2005 the number of individuals per group was 6 to 55 and the total population per

trip sometimes got up to 140 of which many were young. During the same period, over a course of 26.4 km between Ranérou and the enclosure (Katané) only 5 individuals were recorded of which 2 were adults and 3 were young.

Already it can be said that the enclosure has begun to have an attraction for (or on) the fauna of the surrounding area and constitutes a kind of refuge for it. The entry of a caracal (*Felis caracal*) in 2004 and of a male red-fronted gazelle (*Gazella rufifronsI*) in 2005 probably goes in this direction. Other more shy species such as the golden jackal (*Canis aureus*) and the African wild cat (*Felis libyca*) are observed more and more during the day within the enclosure.





REINTRODUCED ANIMALS

Oryx

The apparent state of health of the oryx is excellent. The population count at the end of March 2005 gave a population of 18 (10.8) individuals. Thus, an increase of 10 (8.2) compared to the founder group. Actually, between January 2003 and March 2005, there were 11 (9.2) births except that there was one death for an unknown reason. The sex ratio (1**:**0.8) is biased towards males.

This species seems to be very prolific. In fact, the presence of a guaranteed cover of vegetation all year, some females have already dropped twice since their reintroduction to Ferlo and are again pregnant.

The total population of oryx in Senegal (between the Gueumbeul Reserve and that of Ferlo) grew in March 2205 to 36 individuals divided equally between the two reserves. However, the sex ratio at Gueumbeul is not well known. For this reason, we hesitate to give out data that could later be found incorrect.

Oryx are always observed in a single herd. This is formed of adult males and females as well as young. It is dominated by male No. 02 who is moreover the sire for all births. The second male, also issue of the founding population, is often chased by the alpha male, racing around the herd

Oryx are often found grazing on stretches of *Schoenefeldia gracilis* and *Zornia glochidiata,* two species that are abundant in the enclosure. They prefer open spaces and avoid thickets. These latter are only used by pregnant females, who isolate themselves there to give birth.

Dama gazelles

Their apparent state of health is satisfactory. The total number of dama gazelles has not grown much. In fact, only one birth, a male, has been recorded since January 2003. This brings their total population at Ferlo to 6 (3.3). From this we get a sex ratio of 1 : 1. This qualified result, compared to that recorded for oryx during the same period, is certainly influenced by losses that occurred during the course of transfer. Moreover, this species is known to be sensitive to inbreeding due to the very fact that it springs from a very small population.

The total population of dama gazelles in Senegal in March 2005 was from 26, of which 20 specimens are at the Gueumbeul reserve.

Dama gazelles are often found in relatively wooded sections, especially around *Acacia seyal*, *Leptadenia hastata* and *Calotropis procera* which they quite like. Gazelles are recorded as individuals and in small groups. The calf born at Ferlo is the most timid of all. It is often the calf who detects intruders and initiates flight.

The second male, taken from Gueumbeul while young, was chased from the group by the dominant male in 2003. He mixes, rarely, with the herd of oryx, however he was observed many times in the company of the male red-fronted gazelle (*Gazella rufifrons*) who got into the enclosure in 2005.

HUMAN MATERIALS AND RESOURCES

Despite its 4.870 km², the Ferlo North Reserve is run every day by 6 people: the curator, his assistant, the accountant, the driver and two park officers.

Three people occupy the Katané station there or can be found at the introduction enclosure. The curator and the accountant are at Ranérou the seat of government for the region.

Living conditions at Katané are below average. In addition, daily housekeeping at the station, officers are often asked to solve problems of the local population which leaves them little time to monitor the reintroduced antelopes. During the rainy season, the station is completely isolated because the trails are impassable and the only all-terrain vehicle at the Reserve is often at Ranérou. To open up the reserve, the DPN plans to install solar panels and a radio at the station.

However, some achievements have been made in favour of the local population since the introduction of antelopes.

1. The re-start of well-drilling which has not worked since 1960.
2. The installation of one school class for the children of Katané.
3. Setting up women into an Economic Interest Group (EIG).
4. The creation of a small market garden for the Fafabé and Ferlonqué women of the villages near the reintroduction enclosure.

CONCLUSIONS

Two years after their reintroduction to Ferlo, scimitar-horned oryx (*Oryx dammah*) and dama gazelles (*Gazella dam mhorr*) show appreciable adaptation to their new habitat. The oryx have more than doubled (18). However, the dama gazelles have developed in a less strong way (only one birth) despite a satisfactory state of health. Losses during the transfer certainly influenced this outcome. Characteristics linked to the history of this species cannot be ruled out.

Importation of new blood for the two species will be of great value because both are offspring of a very small group and individuals have a very close parental relationship.

The natural vegetation in the reintroduction enclosure meets the total needs of the antelope species. Only one importation of salt-lick has been introduced to them. Water is provided only during the dry season.

The Restoration of the habitat continues to be manifested by, among other things, the regeneration of the remarkable plant cover and the growth in diversity of its wildlife.

Living conditions in the reserve should be improved to allow officers to concentrate on the monitoring of animals. Regular patrols in the reserve would ensure better preservation of threatened species such as the red-necked ostrich (*Struthio camelus camelus*), the various species of bustard (*Otis arabs, Eupodotis senegalensis, Neotis denhami*), red-fronted gazelle (*Gazella rufifrons*) and the rare striped hyena (*Hyaena hyaena*).

BIBLIOGRAPHY

Barrel, H. (1982). Le Ferlo des barrages. Gestion ancienne et actuelle de l'espace pastoral. ORSTOM, 82 p.

Cano, A., Abaigar, A. & Vericad, J-R. (1993). Etablishmentof group of Dama gazelles for Reintroduction in Senegal*. Int.ZooYb*., 32 : 98-107.

Devilliers, P., & Devilliers-Terschuren, J. (1999a). Rapport sur l'état et les perspective d'une espèce : *Oryx dammah*, pp :105-128., *in* : UNEP/CMS, ed. Mesures de conservation pour les antilopes sahélo-sahariennes. Plan d'Action et rapport sur l'Etat des espèces. *CMS Technical Series Publication N° 4*, UNEP/CMS secretariat, Bonn, Allemagne.

Devilliers, P., & Devilliers-Terschuren, J. (1999b). Rapport sur l'état et les perspectives d'une espèce : *Gazella dama*, pp :149-167., *in* : UNEP/CMS, ed. Mesures de conservation pour les antilopes sahélo-sahariennes. Plan d'Action et rapport sur l'Etat des espèces. *CMS Technical Series Publication N° 4*, UNEP/CMS Secretariat, Bonn, Allemagne.

DEFCCS , (1999). Schéma directeur de la zone écogéographique sylvopastorale (Ferlo). Appui au programme national de foresterie rurale du Sénégal, FAO, 45 p.

DPN (2003a). Programme de Sauvegarde Alimentaire des animaux de la Réserve de Faune de Gueumbeul, Direction des Parcs Nationaux, Sénégal, 5 p.

Dupuy, A.R. (1984). La réintroduction de la gazelle dama au Sénégal. *Le Courrier de la Nature*, 88 : 30-33.

Gilbert, T. (2004). The re-introduction of the scimitar-horned oryx to Senegal. Pp: 82-83, *In*: *The biology, husbandry and conservation of scimitar-horned oryx (Oryx dammah)*. (T. Gilbert & T. Woodfine, Eds.). Marwell Preservation Trust, UK.

IUCN. (2002). The IUCN red list of threatened species.

Jebali, A. (2003). Rapport sur la réintroduction de l'oryx algazelle (*Oryx dammah*) et de la gazelle dama (*Gazella dama mhorr*) dans la Réserve de Faune du Ferlo Nord (RFFN), Sénégal. Mission avril 2003. MNHN/MAVA, 32p.

Mandiang, B. (2000). Perspectives de repeuplement de la Réserve Spéciale de Gueumbeul, Direction des Pars Nationaux, Sénégal, 3 p.

M'Bodj Atef, Y. (2002). Etude relative aux comportements de deux oryx femelles réintroduites le 09 février 2002, à l'entretien et à la gestion de la faune dans la RSFG*. Rapport de stage février- mars 2002, DPN*, Réserve Spéciale de Faune de Gueumbeul, 32 p.

Roure, G. (1956). Faune et chasse en Afrique occidentale française. *Editions G.I.A,* Dakar, 412 p.

Tersiguel, P. & Becker, Ch. (1997) Développement durable au Sahel, *Karthala*- Sociétés, espaces , temps. Paris

Vallier (Capitaine). (1906). Explorations dans le Ferlo. *Bull. Com. Afr. Fr*., 9: 269-285; 10: 325-332; 11: 338-358; 12: 396-403.

An introduction to the IUCN/SSC/ASG – Northeast African Regional Subgroup
Jens-Ove Heckel

In 2002 the IUCN/SSC/Antelope Specialist Group (ASG) decided to reorganize, in order to make the group more effective. It was restructured on the basis of geographical regions or taxonomic groups.

The Northeast African Subgroup (NEASG) is responsible within Northeast Africa for the countries Djibouti, Eritrea, Ethiopia, Somalia and Sudan. Northeast Africa can be considered a hotspot or center of endemism with regard to antelope biodiversity. Several species and subspecies of antelopes, giraffes and buffalos are endemic to this region. Not less than 35 full species (17 endemic, 18 non-endemic) and even 60 species or subspecies (36 endemic, 24 non-endemic) occur in the region. The distribution, ecology and status of some endemic species or subspecies such as beira, dibatag or silver dikdik are unknown or need to be further investigated.

As of all other ASG subgroups, the main objectives of NEASG are:

1. Highlighting problems of antelope conservation by bringing priorities for action to the attention of national and international conservation agencies and in addition recommending practical solutions and providing technical assistance where requested.
2. Monitoring the status of antelopes, by providing information to the ASG as this information becomes available.
3. Assisting with fund-raising for specific antelope projects.

The list of ASG members relevant to the NEASG has been updated through a general questionnaire which was sent to all ASG members in 2002. Five new members have been recruited since then and the admission of further members is being prepared. Currently there are 30 colleagues listed with specific knowledge on antelopes within the Northeast African subregion.

Great effort was made to create a homepage for the NEASG. The first version (only covering endemic species and subspecies) was opened in the internet in May 2004. Since then the homepage has been updated regularly and extended to non-endemic subspecies and species as well as buffalos and giraffes.

The homepage can be found at http://www.iucn.org/themes/ssc/sgs/neaasg.htm.

It is hoped to be able to provide more and more up-to-date data on the species and subspecies of antelopes (as well as buffalos and giraffes) occurring in Northeast Africa in the coming months and years. All ASG members as well as other individuals are asked to provide copies of relevant reports, proposals or photographs to be included in the data bank and on the homepage.

During 2003/2004 more than 100 letters, faxes and questionnaires as well as over 140 emails have been send out to people and international environmental or development organizations and agencies mainly in the given countries to fresh up or create contacts with potential partners on the spot who can provide information on the current status of antelope (as well as buffalo and giraffe) species/subspecies or planned and running conservation projects.

Lately, the NEASG is or was involved in the preparation, implementation or support to the following projects or project proposals:

- General status assessment survey on larger mammals in the Ogaden region/Ethiopia. Followed by:
  - Long term study on the distribution, status and ecology of the dibatag (Ammodorcas clarkei) in the Ogaden/Ethiopia.
  - Survey on the distribution and status of the Speke's gazelle (Gazella spekei) in the Northeastern Ogaden/Ethiopia.

- Supporting conservation efforts for Swayne's hartebeest (Alcelaphus buselaphus swaynei) in Senkele sanctuary/Ethiopia.

- Research on the effect of sport hunting on mountain nyala (Tragelaphus buxtoni) behavioural ecology in Ethiopia.

- General status assessment survey on larger mammals in the Republic of Djibouti. Followed by:
  - Survey on the distribution, status and ecology of the beira antelope (Dorcatragus megalotis) in Southern Djibouti.
  - Development and implementation of an environmental education curriculum for primary schools in Djibouti.

- Assist in the Priority Setting Exercise for antelope conservation in Africa

The Regional Chair participated as delegate in the following meetings relevant to antelope conservation:

- Meetings of the EAZA, Antelope Taxon Advisory Group, TAG

- International Symposium on the Ecology and Conservation of Mini-Antelopes in Zanzibar, Tanzania.

- Meetings of the Zoological Society for the Conservation of Species and Populations, ZGAP"

- 3rd IUCN World Conservation Congress in Bangkok, Thailand.

Main objectives of NEASG within the coming months are:

- Further completion of the data banks and homepage.

- Initiation, implementation or support of antelope status assessment surveys in Southern Sudan, Eritrea, Western Ethiopia and Northern Somalia.

- Re-evaluation and revision of IUCN Red List categories of Northeast African antelope as well as buffalo and giraffe species/subspecies.

Significant financial support provided by
Al Wabra Wildlife Preservation, Qatar
is gratefully acknowledged.

Further support is kindly provided by:
Saint Louis Zoo, USA
Zoological Society for the Conservation of Species and Populations, Germany
Conservation des Espèces et des Populations Animales, France
Naturschutzbund Deutschland, Germany
Zoo Landau in der Pfalz, Germany
Friends of Zoo Landau, Germany
Wildlife Protection Organization, Djibouti
Ministère de l'Habitat, de l'Urbanisme, de l'Environnement et de l'Aménagement du Territoire, Djibouti

Conference Attendees

Break-out Meeting Notes for Niger, Chad, Senegal, Mauritania, Mali,
Chair--Philippe Chardonnet

Framework

Need concrete action steps, not ten year vision. What can we accomplish working together? Try to remember previous discussions, commitments. Need to take responsibility and champions; don't volunteer for things you cannot do.

Niger
Question of who is doing what and plan for coming year.

Arnaud reported they were providing 15,000€ for general awareness, particularly with regard to VIP hunting and supporting SOS (who has been particularly vocal on this issue). It was pointed out this was a broader issue, and whatever was being done in Niger needed to be incorporated into the multi-national programme. It was questioned whether CMS was the appropriate agency to write formal letter—SSIG is already doing this and it would also be appropriate for SCF to take this on. Monica said WCS might also be able to help. It was pointed out that it was important to distinguish between this sort of hunting (illegal/uncontrolled) and hunting undertaken under controlled conditions. SSIG has gone through this carefully and made it clear that they are not anti-hunting; SSIG has already done a pretty good job of defining this issue; have better strength within SSIG representing a number of organizations, than SCF which is a new organization; will listen to CMS acting on technical advice from SSIG even more. Have to take to top international level with negative publicity.

ACTION: SSIG will provide information through SCF to Niger.

Arnaud also reported the first priority for them is to build up DFPP, buying one vehicle, computers, funds for national coordinator. Just waiting for memorandum between CMS and Niger to be signed.

Termit
Arnaud reported their strategy is to facilitate within Niger with two targets:
(1)development of infrastructure (as above); (2) development of community initiatives. A workshop in Zinder will be held for Termit stakeholders. Planning to hold international workshop early in 2006. Need a catalyst to identify who is going to commit funds and action. It is also important to get commitment from the Niger government they are serious about providing legal protection and to consider bringing in representatives from the hunting concessions which have been awarded in this area.
Someone has been recruited (?) to act as intermediary between NGOs and government agencies to get things going. Have written terms of reference, will start in next few months, based in Niamey but with frequent visits to field.

Problems:

- Institutional—DFPP not sure about how to proceed.
- Political—not sure about SOS being best choice because of friction with DFPP.
- Logistical—not sure about relationship with SCF; CMS response will vary depending on this relationship; need a decision.

Need commitment of skills, need institutional framework, co-funding, and field capacity over long term into development of broader project

SCF to meet with Arnaud et al. within the next three months to determine terms of reference for their relationship. SCF agreed that it wants to take lead on this initiative so need to take this further. Also need to be developing a substantial proposal to GEF or the like. Could envisage an advisory board for the facilitator.

Françoise Claro reported that Jerome would be interested in working in Termit area on relations with the Tibbou. Currently there are no funds for this. The collaring operation of addax will not go ahead this year, possibly in October 2006.

Gadabeji
Arnaud reported CMS/FFEM regard this area as a very good candidate, it represents unique habitat that is not protected. The strategy is to build up concept project now.

IGF has applied for funds to provide co-funding, ready to implement in the field.

ACTION: IGF waiting to hear, probably in June. Will then come back to SSIG/SCF and agree on terms of reference. Philippe Chardonnet also working on a soft and social oryx release proposal, Bill Houston, Steve Monfort, Jean Marc Froment to comment on proposal

Air Tenere
$250,000 being put into area by PNUD, does not include antelope conservation.

DFPP has asked to do strategy document for conservation of Sahelo-Saharan antelope.
Have 10,000€, looking for matching funds. SCF can provide time, Arnaud willing to do document.

Ostrich
Looking for technical support, have $5,000, looking for a further $8,000 which if they receive, means SCF will start providing institutional support to the local NGO.

<u>Chad</u>

Director of Chad Wildlife Service reported the fauna has suffered greatly from drought and civil war, in fact, the wildlife has been decimated. There is hope that the wildlife could recover if helped. Two sites have been selected—Ennedi and Ouadi Rimé-Ouadi Achim.The interest is there, but simply do not have the resources, need information material, communication and awareness—locally but also internationally Local awareness programmes are critically needed. Have operational projects in the savannah; GEF is involved in the Manga and there is a prospect of support from Mike Fay, but this is in the very early stages of development and basically there is nothing in the Sahelo-Saharan area. Next step is to try to build project in Ouadi Achim, will take at least two years to develop. Will incorporate local knowledge so first requirement will be a small mission to Ouadi Achim to see how we can cooperate and to start to develop long term project. CMS have small grant from UNEP to bring stake-holders together which is still available, and it can be used for inventories and actions in the field. Jean Marc can also bring some support of two months of his time and salary. UNEP money MUST be spent this year. So it is clear that we have to do something this autumn. Idea of workshop is good – to raise awareness in Chad and to develop critical mass around conservation work and support for conservation work in that area.

ACTION: Formulate a workshop in such a way that a concerted action is undertaken in a strategic manner. Jean Marc wants do a short mission at the end of the year with a project for the next two years, starting something concrete in the field. Research development with local community incorporating conservation of sites, archaeology etc. WCS has proposed that Jean Marc also look at addax and manatee. Very important that we work together—agreed that a small group should go with Jean Marc to Chad in the next couple of months—John Newby/Bertrand Chardonnet/ Arnaud Greth

The Director of Chad Wildlife Service reported he has been given three male dama gazelles. He needs to get them out because they will be given away; would be incredibly valuable to breeding programme. Agree that site visit to assess the dama gazelles.

Mali

National coordinator has been removed (but not been replaced; and previous coordinator has been promoted). It is a real difficulty not to have this post filled. Survey planned for Tamesna at the end of this year. Should support creation of Tamesna reserve; considerable work has been done including the gazetting documents. Just need a little pushing to finalise. CMS needs to write asking who is new coordinator. Meeting in autumn between Burkina Fasso and Mali to discuss establishment of Gourma.

May still be addax on frontier of Mali and Mauritania.

Senegal

Gueumbeul has new dedicated Conservator who is keen to develop ties and to expand his technical expertise. Director of National Parks received a big increase in his budget for national parks of the country which is very good news. Funds from CMS have been provided for transport of animals; have further funds that need to be spent this year. Roseline Beudels and Tim Woodfine to visit Senegal this year to determine how these funds will be spent. No long term strategy for management of released animals; no plan in place and help with this is urgently needed. Not clear what Bill Clark's role; has submitted application to Disney but unclear what participation of the Senegalese has been .

ACTION: Improve genetic make-up of captive herds, especially the scimitar-horned oryx and need to get female *rufifrons* in enclosure (or out of).

ACTION: SCF interested in leveraging support; should consider quick trip down to look at exactly what is needed. Gueumbeul to be included; priority to identify animals to add to group. Will discuss these possibilities at the Antelope TAG (AZA) meeting next month, also possibility of supporting training etc. Will need to start permit application process etc. after that. (Ed Spevak).

Also possible to involve French military who have offered to help with transport of animals.

Mauritania

Majabat – should it be surveyed or not? Have received proposal, but would need a lot of scientific support to implement. Very dubious about terrestrial survey, aerial would be better but difficult from a safety point of view, lots of bandits who would make it very dangerous on the ground. Would be ready support it but think we should do an aerial survey. Proposal to be circulated (Arnaud Greth/Roseline Beudels) Bill Houston said Saint Louis would look at doing it and helping with funds. Survey would need to be done in the cold period.

Break-out Meeting Notes for Morocco, Algeria, Libya, Egypt and Tunisia
Chair—Koen de Smet

Morocco

- A reserve at Daklah (1000ha) has been created and possibly addax from SMNP could be trans-located. Mr. Ribi has been appointed the director.
- Inventory of Cuvier's gazelle of high plateau in the NE undertaken by Fabrice Cuzin
- Inventory of Cuvier's gazelle in the south, is pending and will be conducted by Fabrice Cuzin.
- National Natural Strategy workshop will be held 2005. Management, reintroduction, translocation, assessment. PGAP, Heiner Engel, Tim Wacher, HCEF.
- Training in Bou Hedma NP also for Moroccan staff. FFEM/DGF.
- Public awareness ongoing at SMNP. Eco-museum still needs funding. Southern part of SMNP will open for eco tourism soon. Other initiatives for awareness unknown.
- Genetic research for dorcas gazelle is ongoing by Teresa Abaigar.
- A major point of concern is the population of addax at SMNP 550 addax/240 scmitar-horned oryx.

For 2005-06 the following is proposed for action:

- Short term measure of extending the reserve by an additional 800ha at SMNP.
- Translocation of dorcas gazelle to eastern part of SMNP. Fencing pending.
- Offer to give tissue samples for genetic studies on antelope. Marwell (oryx), Hannover (addax) expressed interest and will contact Widade. Funding?
- Protocols for surveys / monitoring of populations in SMNP as this is needed as model for other P.A.s in Morocco.

Algeria

- New Director (Ramdane) for GEF assistance project for Hoggar / Tassili National Parks. A private company has been given the contract. Not sure who!
- Contacts with Belezma NP—feasibility for reintroduction.
- Provided training in Namibia at CCF for Algerian scientist. Suggest further delegates from range states.

- Better management of captive breeding centre; in discussion with ZSL/ Almeria. Existing breeding centre for slender-horned & dorcas gazelles still in operation.
- Algerian staff to participate in Bou Hedma training course.
- Survey work / training begun with Hoggar NP, university personnel, March 2005.
- Still a need for more training (Tassili) Koen de Smet/ Steve Monfort
- Training in capture / care techniques also to be covered in Bou Hedma
- Need for assistance with pen design / facilities.
- Ungulate mapping / densities. Mostefai has looked at Western High plateaus – published bird data, but now working on mammal data (PhD Natural History Museum). First step was a survey of eastern Hoggar, completed March 2005.
- Continue cheetah / gazelle reconnaissance / training in Tassili n'Ajjer (particularly *leptoceros*) Koen de Smet / Steve Monfort / Tim Wacher.
- Feasibility of antelope reintroductions in Hoggar & Tassili NPs. Koen de Smet / Steve Monfort / Tim Wacher.
- Algeria to join CMS before COP in November 2005.

Libya

- Libya has joined CMS.
- Mohammed Essghaier is active again – supervising PhD on distribution of dorcas . François Lamarque.
- Contacts at CMS COP Koen de Smet/ Roseline Beudels.

Egypt

- Siwa project still operating?
- Gebel Elba NP staff need help for work on Barbary sheep – inventory & management. Koen de Smet
- Tania Gilbert has contact with Cairo zoo regarding oryx stock, which may originate from Sudan rather than Chad. Important for global population / reintroduction.
- Contacts at CMS COP Koen de Smet / Roseline Beudels

Tunisia

- Training – to be done by the end of the year!
- Guidelines done. Distribution Tunisia, Morocco, Algeria.
- Baseline surveys. Draft proposal by Koen de Smet / Tim Wacher submitted to FFEM. Funding allocated, but team (managers & scientists) and co-funding to be decided.
- Dorsal mountain survey ongoing.
- Oryx, addax requirements completed.
- Formal letter sent to DGF following CMS / Zoo community meetings.
- Tunisian official, Garbaya studying oryx diet in Bou Hedma for PhD.
- CMS set out steps in formal letter to DGF.
- Proposals for Djebil, Tim Wacher.
- First addax / oryx translocations December 2005 / linked to multi-national training sessions in Bou Hedma (vet) / all parks for monitoring.
- Breeding facilities in Dghoumes National Park will be ready autumn.
- Public awareness / eco-museum also ready autumn
- Conservation strategy for slender-horned gazelle urgently needed (covering ex situ & in situ components). DGF / FFEM. Arnaud Greth, Terrie Correll, Tim Wacher.
- Creation of proposed NP's / reserves pending.
- Studies on genetics of oryx to be planned DGF / Marwell.