



Convention on the Conservation of Migratory Species of Wild Animals

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SAHELO-SAHARAN ANTELOPES - STATUS AND PERSPECTIVES

Note by the Secretariat

Under this cover is reproduced the final draft of a review report on the conservation status of Sahelo-Saharan antelopes. The document constitutes an update of the document entitled "Conservation Measures for Sahelo-Saharan Antelopes. Action Plan and status Reports", prepared by Roseline C. Beudels-Jamar, Pierre Devillers, Jean Devillers-Terschuren and René-Marie Lafontaine, and published in 1999 by UNEP/CMS as CMS Technical Series No. 4.

The present version has been prepared by Roseline C. Beudels-Jamar, Pierre Devillers, René-Marie Lafontaine and Marie-Odile Beudels, IRSNB, on the basis of recent surveys and of development of conservation efforts. The document is reproduced unedited in the form and the language in which it was received by the Secretariat from the authors. It is submitted to the 13th meeting of the CMS Scientific Council as a contribution to its consideration of progress in the development of the Concerted Action for Sahelo-Saharan Antelopes undertaken under the aegis of CMS. Once finalized, the document is expected to be published as CMS Technical Report Series.

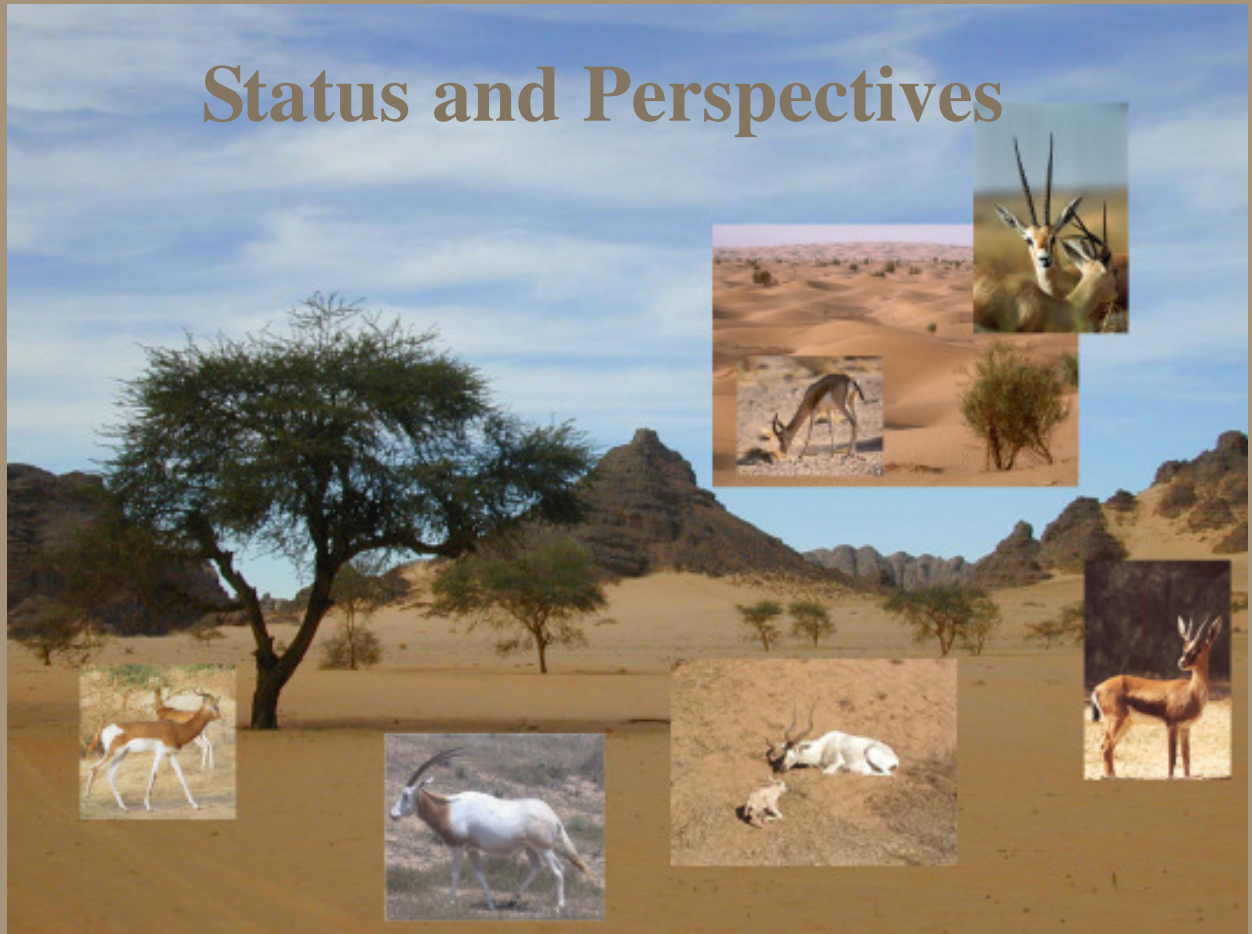
Sahelo-Saharan Antelopes

Oryx dammah
Addax nasomaculatus
Gazella dama



Gazella leptoceros
Gazella cuvieri
Gazella Gazella dorcas

Status and Perspectives



Report on the conservation status of the six Sahelo-Saharan Antelopes
CMS SSA Concerted Action



Realized by the Royal Belgian Institute of Natural Sciences



with the collaboration of :



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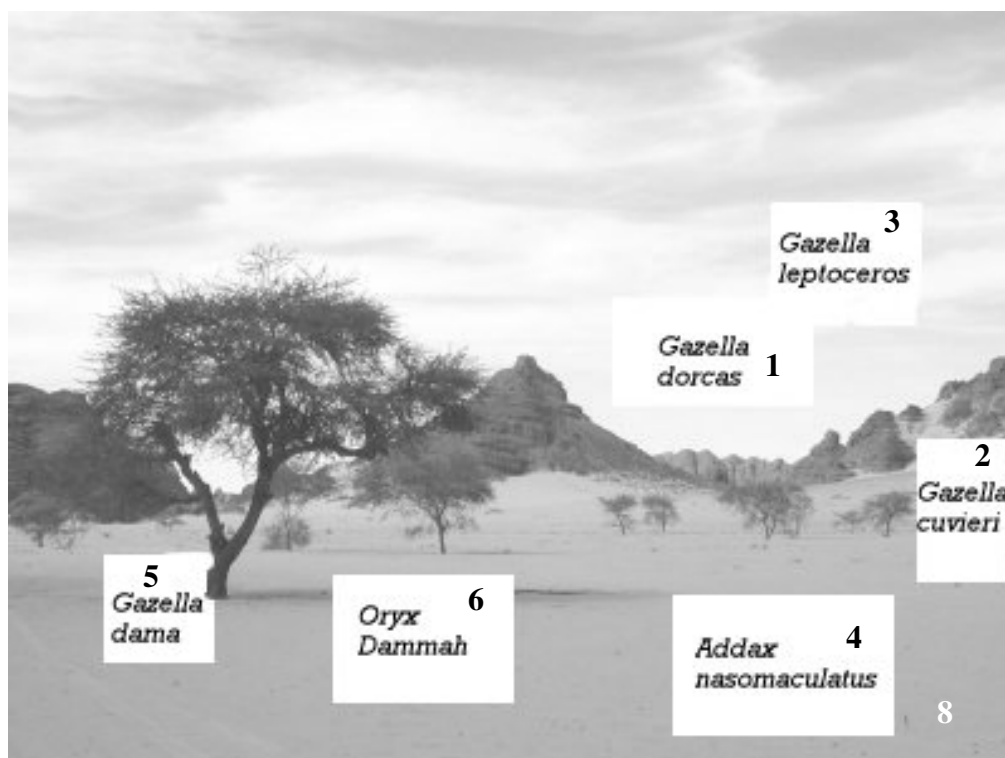
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A french translation is available.

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© Niger. 1. John Newby (SCF); 2. Bou-Kornine - Tunisia. Roseline C. Beudels-Jamar de Bolsée (IRScNB); 3. Tunisia. Koen De Smet (Aminal); 4. Souss-Massa NP. Fatima Oumzai (Service Forestier - Morocco); 5. North Ferlo. Abdelkader Jebali (MNHN); 6. Souss-Massa NP. Marie-Odile Beudels (IRScNB); 7 & 8. Engraved Addax nasomaculatus - Tin Toghert. Tassili N'Ajjer National Park. Algeria. Marie-Odile Beudels (IRScNB).



DRAFT



2d edition- revised 2005

The original documents entitled “Conservation Measures for Sahelo-Saharan Antelopes. Action Plan and Status Reports” were published in 1999 by UNEP / CMS and prepared by Roseline C. Beudels-Jamar, Pierre Devillers, Jean Devillers-Terschuren and René-Marie Lafontaine - IRScNB - 1999.

They were based on documents prepared for the Convention on Migratory Species by Pierre Pfeffer (1993b, 1995) and on supporting documents for the action plan on Sahelo-Saharan antelopes adopted by the 4th Conference of the Parties of the Convention, documents that were prepared by Roseline C. Beudels, Martine Bigan, Pierre Devillers and Pierre Pfeffer (1994). The information it contains originates mainly from the global surveys and regional action plans edited by Rod East (1988, 1990), and the fundamental work of Hubert Gillet (1965, 1969) and John E. Newby (1974, 1988, in particular).

This reports were reviewed and updated by Roseline C. Beudels-Jamar, Pierre Devillers, René-Marie Lafontaine and Marie-Odile Beudels, IRScNB, on the basis of recent surveys and of development of conservation efforts.

SCF and SSIG participated in the review, in particular : John Newby, Tania Gilbert, François Larmaque, Heiner Engel, Tim Wachter, Mar Cano, Fabrice Cuzin, Abdelkader Jebali, Teresa Abigair and Koen De Smet.

Maurice Ascani participated in the review of the Addax status.

Maps: lay-out by Isabelle Bachy. IRScNB.

Marie-Odile Beudels was responsible on the composition, lay-out and finalization of this document. IRScNB.





Oryx dammah



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Oryx dammah engraving. Niger © John Newby



Drawing : Oryx dammah. J.Smit in Sclater & Thomas, 1899

Oryx dammah

1. TAXONOMY AND NOMENCLATURE

1.1. Taxonomy.



Oryx dammah belongs to the tribe Hippotragini, subfamily Hippotraginae, family Bovidae, which comprises one extinct species and seven surviving species together with two evolutionarily distinct subspecies in genera *Oryx*, *Addax* and *Hippotragus* (Simpson, 1945; Corbet, 1978; Murray, 1984; Corbet and Hill, 1986; Wachter, 1988). All hippotraginids are adapted to the exploitation, at low density, of difficult, low-productivity habitats (Kingdon, 1982; Murray, 1984; Wachter, 1988; Beudels, 1993). Genus *Oryx* comprises five evolutionary isolates, of which one, *Oryx leucoryx*, is adapted to deserts, three, *Oryx dammah*, *Oryx gazella beisa*, *Oryx gazella gazella*, to subdesert or semidesert habitats, the last, *Oryx gazella callotis*, to somewhat more productive savannas (Wachter, 1988).

Oryx dammah. Oued Dekouk and Sidi Toui National Parks. Tunisia. © Roseline C.Beudels, IRScNB, and Renata Molcanova

1.2. Nomenclature.

1.2.1. Scientific name.

Oryx dammah (Cretzschmar, 1826)

1.2.2. Synonyms.

Antilope gazella, *Cerophorus gazella*, *Oryx gazella*, *Cemas algazel*, *Aegoryx algazel*, *Antilope algazella*, *Oryx algazella*, *Antilope tao*, *Oryx tao*, *Antilope leucoryx*, *Oryx leucoryx*, *Antilope ensicornis*, *Oryx ensicornis*, *Antilope bezoartica*, *Oryx bezoarticus*, *Antilope dammah*.

1.2.3. Common names.

English: Scimitar-horned Oryx, Scimitar Oryx.
French: Oryx algazelle, Algazel (Buffon, 1764), Algazelle (Cuvier, 1819), Antilope oryx, Oryx blanc.
German : Säbelantilope
Arabic: Wach, Begar al Ouach.
Tamashek: Izem
Toubou: Touroui zode



Pregnant female Oryx. Sidi Toui NP. Tunisia..
© Tania Gilbert-Marwell PreservationTrust



1.2.4. Description.

A large, robust antelope, body pelage cream with reddish-brown colouration on head, neck, lower shoulder and upper legs. In some individuals a reddish-brown lateral flank stripe is visible. Head elongated, cream with face “mask” of reddish-brown blaze on forehead, inverted chevron between horns, vertical line continuous with horn across eye and cheek. Eyes, nostrils, lips, and inner ears black. Ventral surface and insides of legs creamy-white, hooves black. Tail long

(ca. 39% of HB), cream with brown-black terminal hairs. Adults may exhibit reddish-brown tint in pelage covering rump and hindquarters. Nipples = 2+2=4. Sexual dimorphism minimal. Individuals may be reliably identified by horn morphology and pattern of face mask.

The distinctive horns long, ridged (lower one-half or one-third marked by 30-60 corrugations), sharp-tipped and curved backwards in large arc (80-150 cm), giving rise to the common name (Catherine Morrow, *in press*).

2. BIOLOGY OF THE SPECIES

2.1. General biology

2.1.1. Habitat.

Precise data on the habitat of *Oryx dammah* are based mainly on the Sahelian populations and have been collected in Chad (Malbrant, 1952; Gillet, 1965, 1969; Newby, 1974, 1988; Dragesco-Joffé, 1993), in Niger and in Mali (Lhote, 1946; Brouin, 1950; Malbrant, 1952; Grettenberger and Newby, 1990) and, to a lesser extent, in Sudan (Sclater and Thomas, 1899; Wilson, 1978, 1980). There is also precise information for the Atlantic Sahara (Valverde, 1957). There does not seem to be any first-hand information on the ecology of the species in the Libyan Desert of Middle Egypt (Kock, 1970; Osborn and Helmy, 1980), or, *a fortiori*, in the Mediterraneo-Saharan zone. The habitat of the species in these regions can only be understood by extrapolation of the Sahelian information, combined with examination of the sparse data on stable presence and the historically likely distribution of habitats. All the sources converge to establish a typically Sahelian, in particular, north Sahelian, subdesert character of the habitat of the Scimitar-horned Oryx.

The Sahelian populations of the Scimitar-horned Oryx seem to have fed, during the hot, dry season, from March to June, on perennial grasses of the Sahelian steppes, notably *Panicum turgidum*, *Aristida mutabilis* and other species of *Aristida* (Gillet, 1965; Newby, 1974, 1988; Dragesco-Joffé, 1993), the fallen pods of *Acacia tortilis* (Malbrant, 1952; Gillet, 1965; Newby, 1974, 1988; Dragesco-Joffé, 1993), foliage from persistent shrubs, including had, *Cornulaca monacantha*, *Chrozophora senegalensis*, *Cassia italica* (*C. obovata*) and a few herbs, including *Heliotropium strigosum* (Newby, 1974; Dragesco-Joffé, 1993). *Panicum turgidum* seems to also offer cover for newborn calves (Newby, 1974). During the rainy season, from July to September, and during the cold months, from November to February, the Oryx use mainly temporary pastures formed by the emergence of annuals, including the grasses *Cenchrus biflorus* (cram-cram), *Dactyloctenium aegyptiacum*, *Echinochloa colona*, the Aizoaceae *Limeum viscosum*, as well as young green shoots of shrubs belonging to the Fabaceae (*Indigofera*), Nyctaginaceae (*Boerhavia*), Amarantaceae (*Aerva*) (Gillet, 1965; Newby, 1974, 1988; Dragesco-Joffé, 1993); they went north at this time, following the formation of temporary pastures (acheb, gizu) to the edge of the desert (Gillet, 1965; Wilson, 1978; Newby, 1988). Water was provided by the formations of annuals or by other newly green plants, or, in their absence, by succulents growing along wadis and in depressions of the Sahel (Newby, 1988) that remain green until far into the dry season (Newby, 1974). The wild melon, *Colocynthis vulgaris* (*Citrullus colocynthis*), particularly characteristic of the Sahelian subdesert steppes, plays, from this point of view, a particularly important role (Brouin, 1950; Malbrant, 1952; Gillet, 1965; Newby, 1974, 1988; Dragesco-Joffé, 1993). Shade, an essential element of the habitat during the hot months, was assured, like the humidity, by the accessibility, in the Sahelian steppe, of thickly wooded wadis and interdunal depressions (Brouin; 1950; Gillet, 1965; Newby, 1974, 1988; Dragesco-Joffé, 1993). Dense shade trees such as *Maerua crassifolia* were particularly sought-after (Gillet, 1965). *Commiphora africana*, various acacias (*Acacia senegal*, *A. seyal*, *A. arabica*, *A. nilotica*, *A. sieberiana*, *A. raddiana*) and several other Sahelian trees formed fairly dense woods in the preferred zones of occupation in Niger (Brouin, 1950). In sparsely wooded regions shade can be provided by a clump of *Panicum turgidum* (Gillet, 1965). Access to salt deposits was likely indispensable during certain periods (Gillet, 1965).

For the Atlantic Sahara, information is more fragmentary. Morales Agacino (1950) observed the importance of *Aristida plumosa*. Valverde (1957) mentions *Andropogon laniger*. The distribution of the species noted by Morales Agacino (1950) corresponds to the Sahelo-Saharan zone of diffuse acacia woodland and *Aristida* steppes defined by Valverde (1957) and in which he notes the abundance of *Colocynthis vulgaris* and of the shrubby leguminous shrub *Crotalaria*, accompanied by a largely Sahelian cortège.



2.1.2. Adaptation.

Prior to its extinction in the wild, the scimitar-horned oryx inhabited the arid grasslands surrounding the Sahara. Living in this environment explains the behaviour of the species that is characterised by crepuscular activity patterns, migratory tendencies and the ability to adopt flexible strategies for foraging and social organisation (Gilbert & Woodfine, 2004). The scimitar-horned oryx is also physiologically adapted to arid environments and may go for long periods without drinking (Dolan, 1966). While the pale pelage reflects sunlight, the black skin and tip of the tongue protects against sunburn (Mungall & Sheffield, 1994). These characteristics, along with the enlarged hooves, which enable the oryx to walk easily on sand, are adaptations to the arid environment that the animals inhabit.



*Sub-desert steppe with Aristida sp.
Chad. © John Newby*

2.1.3. Social behaviour.

In the wild, and with the exception of old males, the Scimitar-Horned Oryx was rarely observed

isolated. It lived in social groups usually not exceeding a dozen individuals (Le Berre, 1990). Concentrations of several hundreds individuals were not rare in the recent past, where temporary pastures appeared. Concentrations of several thousands individuals were even reported by many authors in Chad and Niger (Lhote, 1945; Brouin, 1950; Malbrant, 1952).



*Bas-Drâa, Morocco. 2003 ©
Marie-Odile Beudels. IRScNB*

2.2. Distribution.

2.2.1. Historical distribution.

The historical distribution of permanent or temporary presence and of movements of the Scimitar-horned Oryx includes all of Saharan and sub-Saharan North Africa between the Atlantic and the Nile.

However, this range was never uniformly occupied, the distribution and extent of effective presence of individuals having always been conditioned by the location of sub-desert zones to which the Oryx is adapted. The Scimitar-horned Oryx seems to need, within an area compatible with its capability of seasonal migrations, an adequate time sequence of therophyte pastures, perennial graminid formations and dry woodland, notably of acacias (Brouin, 1950; Malbrant, 1952; Gillet, 1965, 1969, 1970; Newby, 1974, 1988; Dragesco-Joffé, 1993). This combination of habitats is especially characteristic of regions where annual precipitation is between 75 and 400 mm (Newby, 1988; Thomas and Newby, 1990). In the arid conditions that have prevailed in the Sahara over the last three millennia (Le Houérou, 1986; Newby, 1988), these requirements essentially limit the potential distribution of the species to the northern and southern subdesert fringes, that is, to the Sahel and the Mediterraneo-Saharan transition zone (Rattray, 1960; White, 1983; Le Houérou, 1986; Ayyad and Ghabbour, 1986; Monod, 1986; Newby, 1988; Ozenda, 1991). The ecological conditions favourable to the species can also develop, although on more restricted surfaces or in an unstable manner, in the Atlantic Sahara and surrounding areas (Rattray, 1960; White, 1983; Ozenda, 1991), on the periphery of entral Saharan mountains (Rattray, 1960; White, 1983; Le Houérou, 1986; Ozenda, 1991), and in locations with particular access to the water table (Le Houérou, 1986), notably around large aeolian depressions of the Libyan Desert (Osborn and Helmy, 1980; Ayyad and Ghabbour, 1986; Zahran and Willis, 1992).

The main, Sahelian, range of *Oryx dammah* coincides with the Sahel semi-desert grassland of White (1983), forming his



unit 54a in region XVI. This well-characterised band is also the sub-Saharan *Aristida* steppe zone of Rattray (1960), comprising his units A11, A13, A15, the sub-desert steppes of Newby (1974), the Saharan savannas of Schulz (1988) and of Ozenda (1991). They extend across southern central Mauritania between 18° N (locally 20°) and 16° N, central Mali between 18° and 15°, Niger between 17° and 15°, Chad between 17° and 14°, and Sudan between 17° and 12° 30' (Malbrant and Maclatchy, 1949; Brouin, 1950; Audas, 1951; Dekeyser, 1955; Gillet, 1965, 1969, 1970; Kock, 1970; Newby, 1974, 1975, 1988; Lamprey, 1975; Schnell, 1976; Wilson, 1978, 1980; Monod, 1986; Ayyad and Ghabbour, 1986; Hillman and Fryxell, 1988; Sournia and Verschuren, 1990; Heringa, 1990; Grettenberger and Newby, 1990; Thomassey and Newby, 1990; Millington *et al.*, 1991; Dragesco-Joffé, 1993; Hashim, 1996). The range of the Oryx also included more southern latitudes, advancing into the band of Sahelian deciduous bushland (White, 1983, region XVI, unit 43), in particular, in Senegal (Sournia and Dupuy, 1990), in Burkina Faso (Heringa *et al.*, 1990), in Mauritania (Trotignon, 1975), in Chad (Gillet, 1965; Newby, 1974), in the Sudan (Audas, 1951; Kock, 1970; Wilson, 1980), and even into the Sudanian dry woodlands (White, 1983, region III, unit 29a), notably in Chad, where the 11th parallel was reached during exceptionally dry years (Gillet, 1965) and probably in the Sudan (Audas, 1951). The range of the species also extended northwards to 20° N, in the favourable conditions of the Nile Valley of Sudan (Kock, 1970).

A subdesert fringe somewhat equivalent to the Sahel occurs north of the Sahara in the transition zone between the Mediterranean region and the desert. It is formed of the submediterranean steppe band with *Stipa tenacissima* and *Lygeum spartum* (Rattray, 1960, units ST1, ST2, ST3; White, 1983, region XVIII, unit 55), including *Argania spinosa* woodland (unit 49) or *Acacia gummifera* woodland (unit 79), completed by a part of Rattray's (1960) northern *Aristida* pre-steppe band, forming his unit A16. This Mediterraneo-Saharan fringe is developed over some width and with some continuity only between the Atlantic, where it descends to 27° N, and Tunisia (Rattray, 1960; White, 1983). It exists in a fragmentary way in extreme northwestern and extreme northeastern Libya. The presence of the Oryx in this Mediterraneo-Saharan zone was documented during Roman times, at least in Algeria (Heim de Balsac, 1931; Kowalski and Rzebik-Kowalska, 1991) and Tunisia (Sclater and Thomas, 1899). Climatic conditions then were similar to those that prevail today, but the habitats were very different, with an important representation of thermomediterranean and sub-Saharan dry forests, often dominated by Aleppo Pines (*Pinus halepensis*) or Arbor-vitae (*Tetraclinis articulata*), and of Mediterraneo-Saharan steppes and wooded steppes (Le Houérou, 1986; Damblon and Vanden Bergen, 1993). The Oryx was then associated with several species that are now distinctly Sahelo-Sudanian, in particular, the Bupal, *Alcelaphus buselaphus* and the African Elephant, *Loxodonta africana*. There is no documentation of the presence of stable populations of the species in the Mediterraneo-Saharan zone posterior to Antiquity nor any indication as to choice of habitat in this zone. The last record for Tunisia is from the 20th century (Lavauden, 1920), but its location is imprecise and it could pertain to erratic animals wandering from southern regions, which could also be the case of two Libyo-Egyptian records, one hypothetical (Hufnagl, 1972), the other confirmed (Osborn and Helmy, 1980). In Algeria the only post-Antiquity records date from the 16th century and are hypothetical (Kowalski and Rzebik-Kowalska, 1991). In Morocco, no historical records exist except in the Atlantic region, from the Oued Noun southwards (Joleaud, 1918), including the Drâa basin (Loggers *et al.*, 1992). This region was, however, probably part of the range of Sahelian populations, reaching it across the Atlantic Sahara.



Dahla (Ex-Sahara Espagnol). Morocco
© Marie-Odile. Beudels.IRScNB

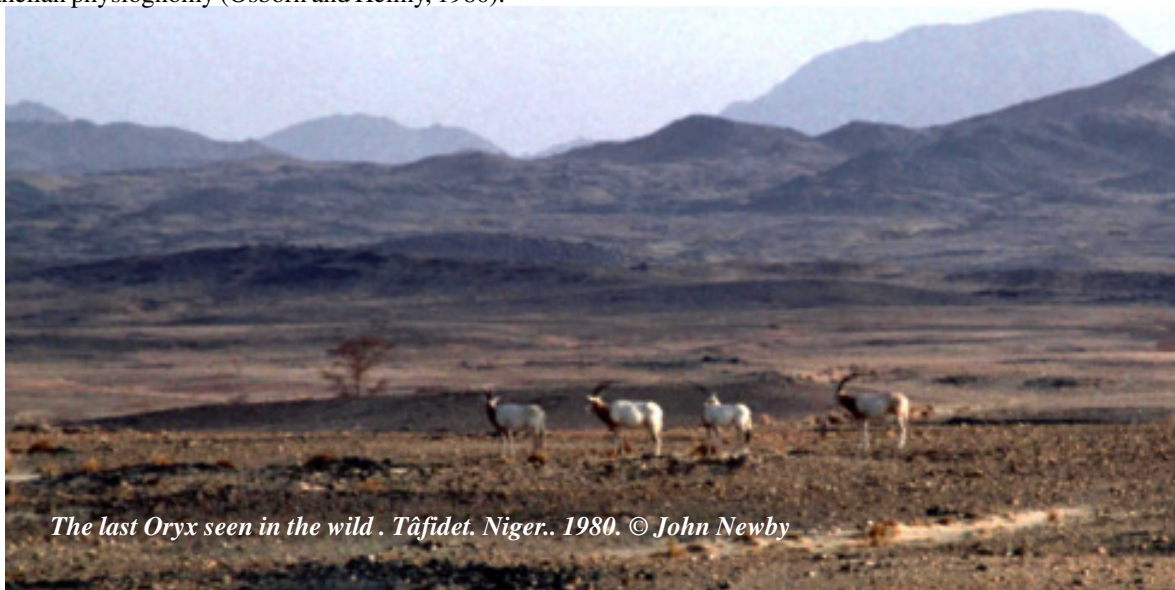


Citrullus colocynthis. Tafidet.
Stipagrostis & *Chrozophora*. Niger © John Newby

Several central Saharan or south Saharan massifs (Heim de Balsac and Mayaud, 1962; Simon, 1965; Ozenda, 1991) offer steep gradients of humidity and vegetation with precipitation attaining 1100 mm in the higher altitudes (Ratray, 1960). They include notably sub-desert steppes with *Aristida*, *sensu* Ratray (1960), corresponding to his unit A14, and various ligneous formations (Schnell, 1977; Ozenda, 1991), in particular, in the valleys. Thus, locally, they reproduce conditions somewhat similar to those of the Mediterranean and Sahelian sub-desert fringes. The southernmost constitute protruding peninsulas of the Sahel (Monod, 1986), rather than islands, or are enclaved in the Sahel. They are the Adrar des Iforas in Mali, the Aïr in Niger, the Ennedi in Chad, the Darfur in the Sudan. All have been part of the Sahelian range of the Scimitar-horned Oryx. The other massifs are insular (Heim de Balsac and Mayaud, 1962; Ozenda, 1991). They include the vast complex formed by the Hoggar and the Tassili des Ajjers in Algeria, the Tibesti in Chad and Libya, the Djebel Uweinat within the confines of Libya, Sudan and Egypt. In these regions there is no indication of a stable presence of the Oryx in historical times (Regnier, 1960; Gillet, 1969; Osborn and Krombein, 1969; Hufnagl, 1972; Misonne, 1977; De Smet, 1989; Kowalski and Rzebik-Kowalska, 1991). Dalloni's (1936) mention for the Tibesti is apparently not based on any record except rock carvings, and Wilson's (1980) record is erroneous since he cites Blancou (1958) who reported on Chad and never on the Tibesti.

The Atlantic Sahara is a cold-current coastal desert. It is an attenuated desert (Monod, 1958; Ozenda, 1991) in which atmospheric humidity and low evaporation compensate the reduced precipitation (Valverde, 1957). These conditions allow the Sahelian flora and fauna to penetrate far north (Valverde, 1957). This coastal desert comprises a narrow coastal band, from 30 to 60 km wide, forming the oceanic Sahara or Atlantic coastal desert (Valverde, 1957; Quézel, 1965; Schnell, 1977; White, 1983, unit 68a; Ozenda, 1991), and a sublittoral zone, extending to 200 or 300 km from the coast, with an abundance of steppes and acacia stands (Valverde, 1957; Ratray, 1960; Quézel, 1965; Schnell, 1977; Ozenda, 1991). This zone is located almost entirely within the former Spanish Sahara and northwestern Mauritania. It is in contact with the Mediterraneo-Saharan zone in the north, the transition being at about 27° N according to White (1983), farther north according to Edmondson *et al.* (1988). In the south, it is in contact with the Sahel, losing its oceanic character around 18° N (White, 1983). The acacia woods and associated steppes of the oceanic subzone, limited in northern areas to favourable sites, notably at the foot of escarpements (Valverde, 1957; Lafontaine, 1995), become more and more numerous and extended, while taking on a more and more Sahelian character, in the south (Valverde, 1957; Schnell, 1977; Ozenda, 1991). Numerous observations of the Scimitar-horned Oryx have been made in the Atlantic Sahara, particularly in the southern part, until the middle of this century (Morales Agacino, 1950; Valverde, 1957; Loggers *et al.*, 1992). This range was in continuity with the Sahelian range and Müller (1996) suggests that it is during periods of drought in the Sahel that the species occupied the Atlantic Sahara as well as the southern Atlantic part of the Mediterraneo-Saharan zone. This hypothesis of irregular presence is coherent with the records given by Morales Agacino (1950). Valverde (1957) suggests, however, a permanent presence in the pre-Sahelian Atlantic Sahara.

A disjunct range of the Scimitar-horned Oryx persisted until the middle of the 19th century in the Libyan Desert of Middle Egypt, in regions of extremely low precipitation, less than 50, or even 25, mm (Kock, 1970; Osborn and Helmy, 1980). The range was evidently linked to the great oases formed in the vast aeolian depressions reaching to the water table, characteristic of this desert (Osborn and Helmy, 1980; Ayyud and Ghabbour, 1986; Le Houérou, 1986; Goodman *et al.*, 1986; Zahran and Willis, 1992). These depressions and the adjacent areas supported woods of acacias (*Acacia raddiana*, *A. ehrenbergiana*) and palms (*Hypophaene thebaica*) and dense grassy steppes, in a combination of habitats with a Sahelian physiognomy (Osborn and Helmy, 1980).



The last Oryx seen in the wild . Tâfidet. Niger.. 1980. © John Newby

Moreover, the distribution of the Scimitar-horned Oryx coincided with that of *Alcelaphus buselaphus*, a distinctly more mesophile species. Essentially limited to Egypt, these oases extend just over the Libyan border at Jaghbub (Bundy, 1976; Goodman *et al.*, 1986). The oases where a historical presence of the Oryx is documented (Kock, 1970; Osborn and Helmy, 1980) include Siwa in the northwest, Wadi Natroun, Faiyum and Wadi el Ruwayan near the lower Nile, Dakhla and the Kharga complex between 24° and 26° N.

It is possible that other areas of presence have existed within historical times, and perhaps as late as the 19th century or the beginning of the 20th century, in Saharan regions where suitable, though probably fragile and unstable, vegetation complexes would have occurred in conjunction with wadi systems or the piedmont of hill ranges. The occupation of such areas by stable populations could explain frequent occurrences in regions far removed from presently known centres of distribution, such as the recurrent captures in southern Tunisia at the end of the 19th century and at the beginning of the 20th century (Lavauden, 1920; Kacem *et al.*, 1994). Precise data do not, however, seem to be available to document such a possibility.

2.2.2. Decline of the range.

The range of the Scimitar-horned Oryx has regressed continuously since Antiquity. The northern sub-Saharan range ceased supporting permanent populations at an unknown date, but almost certainly before the 19th century and in any case by the second decade of the 20th century. (Lavauden, 1920; Kowalski and Rzebik-Kowalska, 1991; Loggers *et al.*, 1992). The generalised destruction of the habitat goes back to Roman times (Le Houérou, 1986) and follows a regressive sequence, irreversible by spontaneous processes, that leads to the disappearance of the Mediterranean dry forests, then of their substitution steppes (Le Houérou, 1986). During the same periods, large-scale taking of all large North African animals was taking place (Newby, 1988). The oases of the Libyan Desert were abandoned by the Oryx at the beginning of the second half of the 19th century (Osborn and Helmy, 1980), the Atlantic region in the middle of the 20th century (Newby, 1988). The Sahelian range was still almost continuous in the 1960's (Gillet, 1969), fragmented into several major nuclei in the 1970's (Newby, 1988), apparently reduced to two fragments, in Niger and in Chad, at the beginning of the 1980's, and, finally, to one in Chad (Newby, 1988). Table 1, taken from Newby (1988), summarises the probable dates of disappearance of the species in each country within the historic range. Table 1 summarises schematically the evolution of its range.

Table 1. Dates of probable extinction of the Scimitar-horned Oryx in the countries within its range, after Newby (1988).

Country	Probable date of extinction compiled by Newby (1988)	Possible late observations, probably of vagrants
Morocco	1930's	
Ex-Spanish Sahara	1963	1973 (a)
Algeria	1960's	1987 (b)
Tunisia	1906 (vagrants?)	
Libya	1940's (vagrants?)	
	1860's (c)	1975 (c)
Egypt	1960's	
Mauritania	1981	
Mali	1983?	1986 (d)
Niger	surviving	
Chad	1978	
Sudan	1850's	
Senegal	1950's	1986 (e)
Burkina Faso		

(a) Le Houérou, 1992; (b) De Smet and Mallon, 1997; (c) Osborn and Helmy 1980; (d) Millington *et al.*, 1991; (e) Heringa *et al.*, 1988.

2.2.3. Residual distribution.

Rumors persist as to the hypothetical presence of Scimitar-horned Oryx in the Sahelian regions of northern Chad, North of the Ennedi (Newby, 1988; Thomassey and Newby, 1990; Moksia and Reouyo, 1996). However the species has not been seen in that area since the 1980's, in spite of searches carried out since 1991 (Pfeffer, 1993a, 1993b, 1995; Beudels



et al., 1994; Tubiana, 1996a, 1996b, Monfort *et al.* 2004). Other regions where a possible survival was mentioned included the border region between Mali and Burkina Faso (Duvall *et al.*, 1997), the Adrar des Iforas in Mali (Kowalski and Rzebik-Kowalska, 1991), the Aïr-Ténéré-Termit in Niger (Grettenberger & Newby, 1990), the Wadi Howar region in the northern Darfur in Sudan (Hashim, 1996). However, the Oryx observed in the Burkinabe Sahel by Heringa in 1986 was probably a misidentified Dama Gazelle (Lamarque, pers.com). In the Adrar des Iforas, reliable reports confirm the disappearance of the species (Lamarque, pers. com.). In the Aïr Ténéré-Termit region in Niger, the possible presence of the species was evoked (Grettenberger & Newby, 1990) and 4 animals were reported, early 2000, south-east of Agadez. This unverified observation was mentioned in an ONC mission report (Saint-Andrieux, 2000). Nevertheless, the Scimitar-horned Oryx seems most likely to have now disappeared from all these regions.

2.2.4. Recolonisation prospects.

The zone of potential distribution of the Scimitar-horned Oryx is the subdesert. It lies between two boundaries, of which one is the limit of the more desert-like regions of the Sahara, the other the more mesic regions of the Sahelo-Sudanian or Mediterranean zones. Towards the desert, the limit is clearly climatic, corresponding to the degree of aridity beyond which adequate grazing land is unable to develop or to maintain itself. Towards the Sudanian and Mediterranean regions, on the contrary, the limit is probably a matter of interaction with other species. Competition with more mesophilous wild ungulates and predation probably play a role, and Brouin (1950) evokes the abundance of parasites as a limiting factor in the south during the rainy season. It is certain, however, that nowadays it is competition with domestic herds and human predation that are the determining factors. The pockets of survival of the species are located in zones of compromise between a too extreme aridity and a too strong human pressure. It is the least unfavourable combination of these two factors that must be sought for the reintroduction or recolonisation zones. Moreover, the more these are located in climatically marginal zones the more they require seasonal displacements and thus vital space (Newby and Sayer, 1976).

Human occupation in the Sahel increased considerably in the middle of the 20th century under the combined effects of a relative peace, above average precipitation, and the boring of deep wells (Newby, 1988). Overgrazing has become generalised, agriculture has progressed and hunting has become motorised and has become universal (Gillet, 1969, 1970; Newby, 1974, 1988; Wilson, 1978; Ayyad and Ghabbour, 1986). Recent Sahelian zones of presence of *Oryx dammah* correspond generally to the proximity of mountain or hill ranges that widen the zone of favourable habitats, augment their diversity and circumscribe regions of reduced accessibility. They obviously constitute the first possibilities to consider for habitat protection or reintroduction efforts. They are, by order of importance, the Ouadi Rimé-Ouadi Achim zone south of the Ennedi in Chad (Gillet, 1965, 1969; Newby, 1974, 1988; Thomassey and Newby, 1990; Dragesco-Joffé, 1993; Pfeffer, 1993a, 1995), the Termit in Niger (Lhote, 1946; Jones, 1973; Newby and Jones, 1979; Newby and Grettenberger, 1986; Newby, 1988; Grettenberger and Newby, 1990; Millington *et al.*, 1991; Bousquet, 1992; Dragesco-Joffé, 1993; Poilcot, 1996a, 1996b), the Wadi Howar zone and the north of the Darfur in Sudan (Lamprey, 1975; Wilson, 1978, 1980; Hashim, 1996), with the neighbouring Chadian massifs, the Adrar des Iforas in Mali (Lhote, 1946; Sayer, 1977; Sidiyène and Tranier, 1990) and its periphery, in southern Algeria (De Smet, 1989; Kowalski and Rzebik-Kowalska, 1991), the southeast of Mauritania (Trotignon, 1979; Vincke *et al.*, 1987).

A second approach could rely on the more southerly zones of the range, probably the most favourable to restoration on a small surface, as long as human pressures can be controlled in regions of high human occupation. Several relatively detailed analyses of the ecology of *Oryx dammah*, carried out during periods when it was still well represented (Lhote, 1946; Brouin, 1950; Audas, 1951), insist on the favourable character of the southern part of its Sahelian range and suggest that the restriction of the Scimitar-horned Oryx to the northern fringes is a result of human pressure and was not ecologically happy. The Ferlo in Senegal (Bille *et al.*, 1972; Bille and Poupon, 1972; Sourmia and Dupuy, 1990; Diop *et al.*, 1996; Clark, 1996), the Gourma region (Réserve des Eléphants) in Mali (Pavy, 1996), the Ansongo-Menaka reserve at the Mali-Niger border (Heringa, 1990), Sahelian Burkina Faso (Heringa *et al.*, 1990) and the Gadabedji reserve in Niger (Dixon and Newby, 1989; Grettenberger and Newby, 1990) appear, in this optic, as interesting deployment possibilities. Protection of the Oryx was, originally, the principle objective of the Gadabedji reserve (Newby, 1988).

In the Mediterraneo-Saharan transition region, habitat degradation dates back to Antiquity and was already advanced in the first centuries of our time. Le Houérou (1986) indicates that dry forests, most often dominated by *Pinus halepensis* or *Tetraclinis articulata* occupied most of the arid zone. He shows that *Stipa tenacissima* steppes succeeded them but that they cannot regenerate in the absence of the protective shade of the trees. Over-exploitation transforms them into shrub formations poorly suited for pasturage. Nearer the desert, these habitats are supplemented by formations of *Acacia raddiana* and relatively fragile subdesert steppes (Le Houérou, 1986). By extrapolation from what is known of the ecology of the Scimitar-horned Oryx in the Sahel, it can be hypothesised that the woods of *Acacia raddiana*, with their accompanying cortège, and the sub-Mediterranean steppes of *Stipa tenacissima* or sub-desert steppes of *Aristida*

that flank them constitute the optimal reimplantation zone for the Oryx in the southern Mediterranean-Saharan fringe (Kacem *et al.*, 1994). Adequate woodland, in juxtaposition with steppes, do not seem to subsist except in a very few places. In Tunisia, Kacem *et al.* (1994) indicated that the conditions favourable to the reintroduction of the Oryx were to be found in the region of Bou Hedma. Muller (1996) identified the region of the lower Drâa valley in Morocco as having similar characteristics as the Bou Hedma region. These two sectors appear to be very important for the redeployment of the species in the Mediterranean-Saharan zone. Other localities have proved interesting, in successful reintroduction efforts in large enclosures, for example, in Tunisia, within Sidi Toui National Park (6135 ha) and Oued Dekouk Nature Reserve (6000 ha). Another protected area, Dghoumès Nature Reserve (8000 ha), in the northern part of the Chott al Djarid, is ready to accommodate Oryx as well. Certain manipulations of the habitat have proved necessary in these protected areas, such as the plantation of *Acacia raddiana* and its cortege of species (Kacem *et al.* 1994). More Mediterranean sites, in which open dry forests of *Pinus halepensis* or *Tetraclinis articulata* and *Stipa tenacissima* wooded steppes persist or could be rehabilitated, might also be considered.

It is not entirely clear that the Atlantic Sahara constituted, in the recent past, a zone capable of permanently harbouring autonomous populations of the Scimitar-horned Oryx, without exchange with the Sahel. Nevertheless, an attempt at establishment should be made, by means of protection and, if the case arises, restoration of the habitat. The projected national park in the Dakhla region, in the zone of the highest density of historical observations of *Oryx dammah* (Loggers *et al.*, 1992), offers the most favourable site, on the condition that sub-oceanic ensembles of grassy steppes and acacia woodland (Valverde, 1957) can be included or re-established in sufficient quantity. Another site of particular interest is the lower Drâa valley, a proposed National Park (286.000 ha), with very extensive formations of *Acacia raddiana*, and with good populations of the remarkable original fauna and flora still present.

On the opposite side of the range of the species, the feasibility of restoring sedentary populations around one, or several, of the oases of the Western Desert of Middle Egypt should be studied. Such a project would depend on the possibilities of controlling human pressures in sites that are necessarily of multiple use, and of which the habitats have been profoundly modified since the period of presence of the Scimitar-horned Oryx (Goodman *et al.*, 1984). The Siwa oasis, relatively remote, and not too distant from an additional complex of oases across the border in Libya, may be the best suited (Meininger, 1998).

Given the absence of historical observations, the Centro-Saharan massifs do not appear to be very favourable to the implantation of the Scimitar-horned Oryx. Still, the existence in Algeria of national parks, constituted or projected, of exceptional dimensions on a continental scale (Bousquet, 1992), the Hoggar and the Tassili des Ajers, could be favourable for an experiment. Rehabilitation of some habitats would very likely be necessary. Such habitats could be selected around the wadis of the piedmont and their gallery woods (Schnell, 1977).

These considerations permit the identification of 15 zones that appear particularly favourable to reimplantation of the Oryx. They are summarised in Table 2.

Table 2. Zones of potential reimplantation for *Oryx dammah*.

Segment of the potential range	Country	Site
Main Sahelian range	Chad	Ouadi Rimé-Ouadi Achim
	Niger	Termit
	Mali	Tamesna
	Sudan	Wadi Howar-Darfur
	Mauritania	Southeast
Southern Sahelian range	Senegal	Ferlo
	Mali	Gourma, Ansongo-Menaka
	Niger	Gadabedji
	Burkina Faso	Sahel
Southern Mediterranean-Saharan range	Tunisia	Bou Hedma, Sidi Toui, Dghoumès, Oued Dekouk
	Morocco	Drâa
Saharo-Atlantic range	Morocco (ex-Spanish Sahara)	Dakhla
Libyan Desert range	Egypt	Oases, in particular Siwa
Centro-Saharan massifs	Algeria	Hoggar, Tassili des Ajers

2.3. Evaluation and evolution of populations

No estimate of the size of populations of the Scimitar-horned Oryx in the 19th century were attempted. In the 20th century, the species was almost entirely limited to the Sahel. Until the middle of the century it seems to have been common there, herds of several hundred head and sometimes several thousand being recorded, notably in Chad and Niger (Lhote, 1945; Brouin, 1950; Malbrant, 1952). In the 1950's and the early 1960's, the Sahelian populations were still considered substantial (Newby, 1988). Herds of 100 or more were still regularly reported in Chad in the early 1960's (Gillet, 1969). In the late 1960's, Gillet (1969) estimated that there were only small populations left in Niger and farther west, and a very few, probably errant animals, in eastern Chad and eastwards. Groups of more than 100 animals were still recorded in Niger during this period (Dragesco-Joffé, 1993).

By the end of the 1970's the world population was evaluated at some 6000 individuals (Newby, 1988), located almost entirely in the Ouadi Rimé-Ouadi Achim region. Here, Oryx were estimated to number 4000-6000 head in 1975-1978, following an energetic anti-poaching campaign and a number of good rainy seasons which allowed a strong increase (Newby, 1988; Thomassey and Newby, 1990). The rest were located in Niger (Grettenberger and Newby, 1990), with perhaps a few small surviving groups elsewhere, e.g. Mali (Heringa, 1990). At the beginning of the 1980's, the Nigerien population numbered less than 200 head (Grettenberger and Newby, 1990). The Chadian one was unknown, but probably reduced to the same order of magnitude, following the interruption of protection in 1978 (Thomassey and Newby, 1990) and the subsequent civil war in Chad. Oryx have not been seen in Niger since 1986 (Grettenberger and Newby, 1990; Millington et al., 1991). From time to time, unconfirmed observations are reported. If the species did survive in Northern Chad, for example, it could only be in very small numbers (Pfeffer, 1993a, 1993b, 1995; Beudels et al., 1994; Tubiana, 1996a, 1996b; Lefol, pers. Comm.).

2.4. Migration.

In the Sahelian range of the Scimitar-horned Oryx, seasonal migrations of a substantial amplitude, up to several hundred kilometres, have been recorded (Brouin, 1950; Malbrant, 1952; Gillet, 1965, 1969; Dupuy, 1967; Newby, 1974, 1988; Dragesco-Joffé, 1993). The migration cycle, particularly well-observed in Chad, is summarised as follows (Gillet, 1965, 1969; Newby, 1974, 1988). During the hot season, from March to May, the Oryx are found in the southern part of their range; at the beginning of the rains, that appear in the south of the Sahel at the end of May or the beginning of June, they move further south, to the sub-Saharan wooded steppes. At the end of June or in July, they perform rapid, massive migrations towards the north of their range, where the rains have started, taking advantage of the therophytic pastures to the extent that competition with domestic herds permits. In August they reach the northernmost latitudes, between the 16th and 17th parallels. In October and November, the large herds disperse for the cold season. They return in March towards the summer quarters. This cycle varies in function of the irregularities of the annual rainfall. During low-rainfall years they can be forced to spend most of the year near the summer quarters; inversely, during years with abundant rainfall, they can prolong their stay in the north. Similar migrations have been observed in Niger (Lhote, 1946; Brouin, 1950; Malbrant, 1952), and in Sudan (Audas, 1951; Schomber, 1963). Errant individuals or small groups in search of pastures probably often go beyond the limits of regular migrations (Wacher, 1988; Dragesco-Joffé, 1993). It is possible that this nomadism has increased recently under the effects of persecution and habitat degradation (Dragesco-Joffé, 1993). This erratic behaviour, notably of isolated males (Wacher, 1988), explains, in any case, the isolated observations made relatively often far from the permanent ranges.

Cyclic migrations, seasonal or interannual, of the Scimitar-horned Oryx have a cross-border nature, at least between Mauritania, ex-Spanish Morocco and perhaps Algeria (Valverde, 1957; Trotignon, 1975), between Mali and Niger (Lhote, 1946), between one or another of these countries and Algeria (Lhote, 1946; Dupuy, 1967; Kowalski and Rzebik-Kowalska, 1991), between Mali and Burkina Faso (Heringa, 1990; Heringa *et al.*, 1990), between Niger and Chad (Dragesco-Joffé, 1993), and between Chad and Sudan (Lambert, 1975; Wilson, 1980; Hillman and Fryxell, 1988).

3. CONSERVATION STATUS, BY PARTY

IUCN : RedList of Threatened Species 2004 : EW

Morocco : extinct in the wild ; reintroduced in large fences within protected areas.

The presence of the Oryx during historic times is not documented except for the regions south of the Oued Drâa





Oryx poached during the 70'. OROAGR.Chad. © John Newby



The Ouadi Achim, on the horizon (OROAGR).Chad. Habitat and Oryx horn. 2002. © Tim Wachter- ZSL



Réserve de Faune de Gadabéji. Niger. © SSIG-SCF.



Sahelian grassland: dry and wet seasons. Niger. © John Newby



Sahelian grassland with nomads. Chad. © John Newby

(Morales Agacino, 1950; Valverde, 1957; Loggers *et al.*, 1992) or perhaps of the Oued Noun (Joleaud, 1918). In the southeastern part of the Spanish Sahara, in the region of Sahelian affinity, groups numbering up to 25 or 30 individuals could still be seen during the first half of this century, when pastures, particularly of *Aristida plumosa*, were abundant (Morales Agacino, 1950). In 1957, Valverde estimated that there remained no more than one or perhaps two groups. The last observations were in 1963 (Newby, 1988) and 1973 (Le Houérou, 1992), the latter record referring to a single, isolated individual. The Scimitar-horned Oryx was reintroduced in Morocco within large enclosures (Reserve d'Arrouais : about 1000 ha) in Souss-Massa National Park : from the 25 animals originating from European zoos, there are now (Feb 2005) approximately 240 Oryx in the park (Widade Oubrau, Souss Massa National Park, pers. comm.). Although the Souss-Massa region is not part of the original distribution of the Oryx, the Park is used as a stepping stone towards reintroduction of the species in its former range. The presence of the Oryx in Souss-Massa is very important in terms of public awareness, and even more important in terms of reappropriation of the species by the people of Morocco.

Algeria: extinct.

The presence of the Oryx in the Mediterraneo-Saharan zone of Algeria is not documented beyond the Roman era, or perhaps the 16th century (Heim de Balsac, 1931; De Smet, 1989; Kowalski and Rzebik-Kowalska, 1991). In extreme southern Algeria, the southeastern Tanezrouft was probably, until the 1960's, part of the range of Malian populations from the Adrar des Iforas, and the southwestern Tassili Oua-n-Ahaggar part of the range of the Nigerian populations from the Aïr, as Dupuy (1967) supposed. However, few observations support this hypothesis (De Smet, 1989; Kowalski and Rzebik-Kowalska, 1991). Two individuals killed in the region of the Tassili des Ajers in 1987 (De Smet and Mallon, 1997) could have been wanderers coming from the Sahel.

Tunisia: extinct in the wild ; reintroduced in large fences within protected areas.

The Scimitar-horned Oryx was present at least until Roman times in the Mediterraneo-Saharan zone of Tunisia (Sclater and Thomas, 1899). There are no later data, except for a few captures at the beginning of the 20th century (Lavauden, 1920) that could pertain to wandering animals coming from southern regions. The species has been reintroduced in the Bou Hedma National Park (Bertram, 1988; Bousquet, 1992; Kacem *et al.*, 1994), in an adequate environment, and in a habitat of steppes and *Acacia raddiana* woodland, the restoration of which (Karem *et al.*, 1993; Kacem *et al.*, 1994) is a remarkable success, and makes it the best example of this type of habitat in the northern fringe of the Sahara (Bousquet, 1992). The Oryx population of Bou Hedma National Park currently numbers 130 animals (Jan. 2005); the entire protected area covers 16448 ha, the Oryx roaming over a 5000 ha. fenced area within the Park. Additional individuals, of the order of 15 and originating from various European zoos, were imported in Tunisia in 1999 and released in Sidi Toui National Park (6135 ha.) and Oued Dekouk Nature Reserve (6000 ha.).

Libya: extinct.

Rock paintings, notably in the Tibesti and the Djbel Uweinat, attest to the existence of prehistoric populations of the Scimitar-horned Oryx. There are no sure records of its presence in Libya during historical times (Hufnagl, 1982). However, in the 19th century, animals occupied the oases of the Libyan Desert of middle Egypt very near the Libyan border and *Alcephalus busephalus*, which was associated with the Oryx in most of the oases, was known from at least one depression within Libyan territory. Thus, it is possible that Libya was within the range of these populations. Dragesco-Joffé (1993) suggests that wandering animals belonging to the Chadian population might have entered southern Libya. A plausible, but uncertain, observation of an individual was made in the Mediterranean northeast in 1942 (Hufnagl, 1972). It recalls a record considered to be certain in northwestern Egypt in 1975 (Osborne and Helmy, 1980).

Egypt: extinct.

Until the middle of the 19th century, numerous observations of the Oryx were reported, in the oases of the Western Desert, in particular in the Siwa oasis in the northwest, the Wadi Natroun, the Faiyum and the Wadi el Ruwayan near the lower Nile, the enormous oases of Dakhla and the Kharga complex between 24° and 26° N (Kock, 1970; Osborn and Helmy, 1980). There are no records for this period outside these oases and their vegetation systems. This concentrated distribution is characteristic of most of the mammals of the Western Desert (Osborn and Helmy, 1980) and probably reflects the reality of distribution in this nearly unvegetated desert (Osborn and Helmy, 1980; Monod and Sers, 1994) rather than the distribution of observers. The latest records date from the 1850's and 1860's (Flower, 1932; Kock, 1970; Osborn and Helmy, 1980). A single more recent observation exists, that of an animal seen in the Mediterranean coastal desert in extreme northern Egypt in 1975 (Osborn and Helmy, 1980). This record probably pertains to a far-wandering animal coming from southern populations.



Mauritania: extinct.

Southern and western Mauritania make up part of the Sahelian and Atlantic Saharan ranges of the Scimitar-horned Oryx; these ranges were probably continuous, but the existing records do not document this. The first relatively precise information on the distribution of the species in the country seems to date from the 1930's (Trotignon, 1975). During this period, the Oryx was recorded in the west, the centre and the east of the Sahelian steppe zone, as well as along the northern border of this zone in the regions of Dhar Tichit, Dhar Oualata, 'Adafer and Aklé Aouana. A second zone of presence was located in the Spanish Sahara. There are records, during the 1940's, for the east of the Sahelian zone and its northern limit (Trotignon, 1975). In the 1950's, the observations cited by Trotignon (1975) are confined, on the one hand, to the east of the Sahelian region, between Oualata, Nema and the Malian border, on the other hand, to the immediate vicinity of the south-eastern border of the Spanish Sahara, in continuity with the records given by Morales Agacino (1950). The last observation apparently dates back to 1959 and pertains to the Atlantic population (Trotignon, 1975; Newby, 1988; Sournia and Verschuren, 1990).

Mali: extinct.

The Sahelian range of the Scimitar-horned Oryx extends across Mali from Irrigi in the west to Azouak in the east, between 18° and 15° N, with an extension to 20° N and to the Algerian border at the periphery of the pene-Sahelian massif of the Adrar des Iforas (Lhote, 1946; Gillet, 1969; Dupuy, 1967; Trotignon, 1975; Sayer, 1977; Newby, 1988; Heringa, 1990; Sidiyene and Trainer, 1990). Lhote (1946) indicates its presence in the entire Sahelian steppe zone, including in the Niger river bend, in particular, in the Hombori region, in the immediate vicinity of what is now the Elephant Faunal Reserve and at the latitude of the Ansongo-Menaka reserve. The last data from Mali appear to be from the end of the 70's and the beginning of the 80's and come from the extreme eastern part of the country (Sayer, 1977; Newby, 1988; Heringa, 1990).

Niger: extinct.

The Sahelian range of the Scimitar-horned Oryx crosses Niger from the Azaouak to the southern Ténéré, between the 15th and 17th parallels (Lhote, 1946; Brouin, 1950; Gillet, 1969; Jones, 1973; Newby, 1988; Grettenberger and Newby, 1990; Dragesco-Joffé, 1993; Poilecot, 1996a, 1996b). In the 1940's, the main concentrations were observed south of the Aïr, moving between the Tadéras region and the southeastern edges of the massif, in the vicinity of the Ténéré (Lhote, 1946; Brouin, 1950). Brouin (1950) qualified the "very wooded" Tadéras region, between 15° 30' and 16° 30' latitude, and between 6° 30' and 9° longitude, as preferred Oryx habitat, as well as preferred *Gazella dama* habitat. At the end of the 1960's, large groups of Oryx still occupied their traditional range (Dragesco-Joffé, 1993). During the 1970's, the species seems to have been reduced to small groups (Dragesco-Joffé, 1993) living on the desert edges between Agadez and the Termit (Grettenberger and Newby, 1990). At the beginning of the 1980's, drought probably forced the survivors to the southern part of their normal range, in an area where they were exposed to increased anthropic pressure; at that time, the population was estimated at less than 200 individuals (Grettenberger and Newby, 1990). The last observations in Niger are from 1983 (Newby, 1988; Grettenberger and Newby, 1990) and 1986 (Millington and *al.*, 1991).

Chad: extinct.

Until its disappearance from the wild, Chad had been for a long time the home of the largest remaining population of Scimitar-horned Oryx. Already in the 1930's, the Oryx seemed much more abundant in Chad than in more western or eastern regions (Malbrant, 1952). They were distributed over the entire Sahelian belt, mostly between the 14th and 17th parallels, from the Niger border in the west to the Ouaddaï, Kapka, and Ennedi massifs and the Mourdi depression in the east (Newby, 1974). Large herds of several hundred, even several thousand, animals were regularly observed (Malbrant, 1952; Thomassey and Newby, 1990). In the 1950's and 1960's, the species seems to have maintained itself throughout its range (Newby, 1974). In 1962-1963, herds of around a hundred individuals were still frequently observed, one herd of several hundred animals (at 14° 23' N) and another of 600 head signalled (Gillet, 1965, 1969). Gillet (1969) believed that the number of animals had not been reduced, at least in the Ouadi Rimé-Ouadi Achim region during the 1960's. In the 1970's, the Oryx practically disappeared from the region between the 20th meridian and the eastern border mountains (Newby, 1974). By then it had become rare also in the western part of the country. In the mid-1970's, more than 95% of the remaining world population was concentrated in the Ouadi Rimé-Ouadi Achim region, between 18° and 20°E and between 15°N and the southern part of the Djourab (Newby, 1974; Thomassey and Newby, 1990). In 1975-1978, the population in that region was estimated at 4000-6000 individuals, after a period of substantial increase due to efficient anti-poaching work and a favourable series of rainy seasons (Thomassey and Newby, 1990). From 1978 on, a rapid decline took place as a direct consequence of military activities in the country. At the beginning of the 1980's, the

Chadian population was reduced to “the lower hundreds or less” (Newby, 1988; Thomassey and Newby, 1990). Recent surveys (Pfeffer, 1993a, 1993b, 1995; Beudels et al., 1994; Tubiana, 1996a, 1996b; SSIG 2001) could not confirm the survival of the species. From time to time, unconfirmed observations are reported. If the species did survive in Northern Chad, it could only be in very small numbers, or isolated individuals.

Sudan: extinct.

At the beginning of the century, the Scimitar-horned Oryx was distributed throughout the entire Sahelian zone of the Darfur and the Kordofan (Audas, 1951; Kock, 1970; Wilson, 1980; Hillman and Fryxell, 1988). Along the Nile valley, it was found as far as 20° N (Kock, 1970). In Kordofan, it was apparently common in the southern part of the northern Sahelian steppe zone (White, 1983, unit 54a) and in the entire southern Sahelian zone of deciduous shrubs (White, 1983, unit 43), between 12° 30' N and 16° N, to the south as far as the southernmost limit of the Sudaniens woodlands (White, 1983, unit 29a), migrating seasonally like in the other part of the Sahel (Audas, 1951; Kock, 1970). The last observations are from the end of the 1920's (Audas, 1951). In the 1930's, numbers were already dangerously low throughout the country (Audas, 1951). The Scimitar-horned Oryx remained however apparently well represented until the 1940's in the Sahelian steppes of northern Darfur, adventuring north to the desert's fringe to make use of temporary pastures or *gizu* (Lamprey, 1975; Wilson, 1978, 1980). From the 1950's on, data become rare (Wilson; 1980). The last precise data are of groups of up to 50 individuals in the Wadi Howar region and on the temporary *gizu* pastures north of the Wadi Howar in 1964, observed by Hussain Dosa and reported by Lamprey (1975), and the capture of an individual at the westernmost part of the Sudanian Wadi Howar in 1973 (Lamprey, 1975). Newby (1982, 1988) estimates that extinction took place in the 1970's.

Senegal: extinct in the wild ; reintroduced in large fences within a protected area.

The southern part of the Scimitar-horned Oryx potential Sahelian range, the sub-Saharan deciduous shrub zone, includes northern Senegal, from the Louga region in the west to the Bakel region in the east (White, 1983). The species was present in the area (Sournia and Dupuy, 1990). The extinction date is not clearly known. It is situated in the 1850's by Newby (1988, on the basis of informations given by Dupuy), before 1914 by Sournia and Dupuy (1990).

A reintroduction program started with 8 individuals imported from Israel (>20 individuals in October 2005. Jebali, comm.pers.); after a sojourn in Gueumbeul Reserve (720 ha), animals were introduced in a 600 ha enclosure within North Ferlo. The current population in the enclosure counts 23 individuals (Jebali, October 2005. comm. pers.).

Burkina Faso: extinct.

Northern Burkina Faso, north of 14° N, is situated in the south-Saharan deciduous shrub zone (White, 1983). The Scimitar-horned Oryx used to occur there, and probably went extinct in the 1950's (Heringa and *al.*, 1990).

Nigeria: past presence uncertain.

The northeasternmost part of Nigeria, in the Lake Chad and Jawa region, is situated in the south-Saharan deciduous shrub belt (White, 1983; Anadu and Green, 1990). A much larger area, north of the 12th parallel in the west and the 8th parallel in the east, is part of the Sudanian savannahs and woodlands (White, 1983; Anadu and Green, 1990). The presence of the Scimitar-horned Oryx in either of these zones in the past (Sclater and Thomas, 1899) is possible but not clearly established (Anadu and Green, 1990).



Vegetation outside and inside a protected area. Tunisia. 2005.
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4. ACTUAL AND POTENTIAL THREATS

The decline of the Scimitar-horned Oryx took place under the combined effect of several factors acting simultaneously, anthropogenic degradation of habitats, arid land environmental stochasticity, taking, loss of habitat caused by human pressure. These factors remain active today.

4.1. Degradation and decline of habitats.

Catastrophic droughts. Within the context of aridity that has prevailed in the Sahara for the last 3000 to 4000 years (Le Houérou, 1986; Newby, 1988), years of increased drought, affecting in particular the Sahel, appear at irregular intervals (Monod, 1986). During the 20th century, severe Sahelian droughts took place in 1913- 1914 (Monod, 1986), in 1940-1945 (Monod, 1986; Newby, 1988), then, with a particularly high frequency, in 1968-1973, 1976-1980 and 1983-1984 (Monod, 1986; Newby, 1988; Hassaballa and Nimir, 1991). Drought periods always have a catastrophic effect on arid land fauna. The impact of recent episodes on migratory palaeartic birds wintering in the Sahel has been amply documented and commented. The effects of such natural catastrophes have been seriously aggravated by their combination with anthropogenic factors. They hit Sahelian antelope populations which had already been pushed by anthropic pressure towards sub-desert zones at the limit of their aridity tolerance. They forced these populations to re-shift southwards, to areas where the pressure of pastoralists and farmers is much higher (Newby, 1988) and the risk of taking is greater (Newby, 1982). Moreover, the level of human occupation of the land hampers vegetation regrowth after the droughts (Millington and *al.*, 1991).

Degradation of pastures through overgrazing. The capacity of the excellent grazing areas of the sub-desert steppe to support an enormous primary production of graminids and other perennial plants, combined with relatively low levels of competition and predation, explain the past abundance of the Oryx (Newby, 1974). Major increases of domestic stock and the possibility created for this stock, thanks to the drilling of deep wells, to permanently use grazing land situated in waterless areas, have lead to generalised intensive overgrazing (Newby and Sayer, 1976; Newby, 1978a; Newby, 1988). For the entire northwestern Saharan and sub-Saharan regions, Le Houérou (1986) evaluates grazing pressure to be twice the carrying capacity, and notes among its effects the elimination of perennial grasses and browsable shrubs, trampling and compaction of soils, their denudation and consequent eolian erosion. For the Sahel, Monod (1986) indicates grazing pressures of 0.8 to 1 sheep-equivalent per hectare, for a carrying capacity of 0.25 sheep-equivalent per hectare, a load four times too high, leading to severe and generalised overgrazing. The effects of such overexploitation are well described for the Sudan by Bari (1991) who documents the transformation of rich pastures of short grasses and perennials into absolute desert, and by Hassaballa and Nimir (1991) who note a 5 to 6 kilometres progression of the desert per annum. The destruction of feeding grounds, notably the *Cornulaca* formations, by overgrazing, has also been observed in Chad, in the areas of late persistence of the species (Newby, 1974).

Cutting of woody plants. Woody plants seem to be essential to the Oryx, for shade and for food. Their systematic destruction in the Sahelo-Saharan region is an



Desertification. Niger/Chad © John Newby



Nomads and herds at deep borehole. Chad. © John Newby



historical constant (Le Houérou, 1986). It increased sharply in recent times in the southern fringe of the Sahara, under the combined effects of drought and need for charcoal (Newby, 1988; Bari, 1991; Hassaballa and Nimir, 1991). In Sudan, for example, Bari (1991) documents the total disappearance of *Acacia tortilis*, *Acacia raddiana*, *Acacia senegal*, and *Merua crassifolia* woodlands, and their replacement by absolute desert.

Loss of optimal habitats. It is likely that as early as the 1950's, the Oryx was forced out of the most ecologically favourable areas by development pressures. Drought-induced reduction of available range, and increased accessibility for the domestic stock to marginal lands, have progressively removed any buffer zone, and finally any separation, between wild fauna and domestic animals (Newby and Sayer, 1976). The wild fauna is quickly excluded from common use areas. During the last years of survival of Oryx in the Sudan, Wilson (1978) noted that *gizu*, therophytic pasture, while still appearing in abundance, had become inaccessible to the antelopes because of excessive loads of domestic stock.

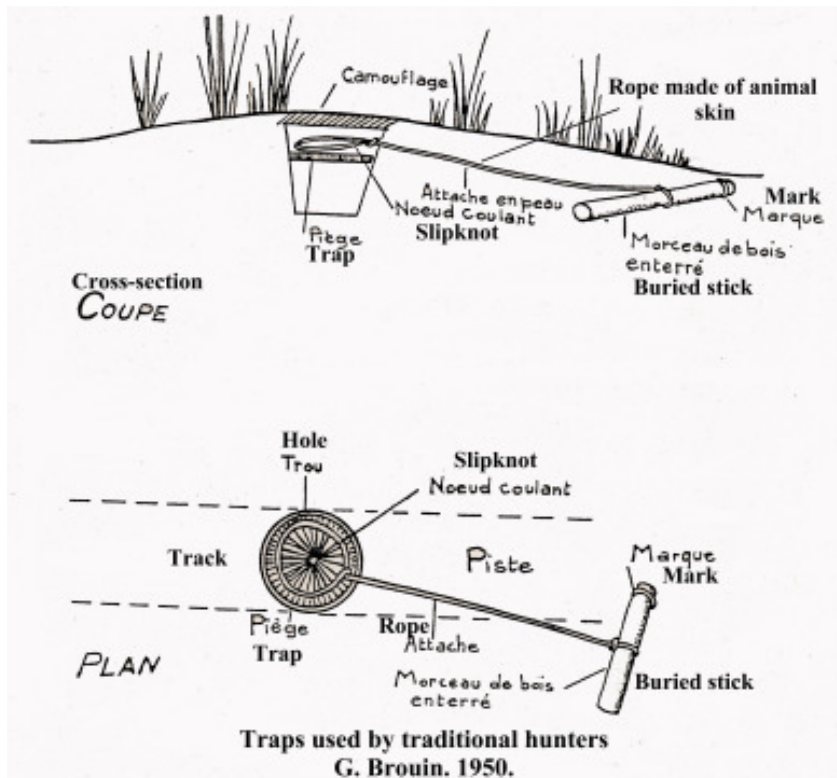
4.2. Direct exploitation.

Traditional hunting.

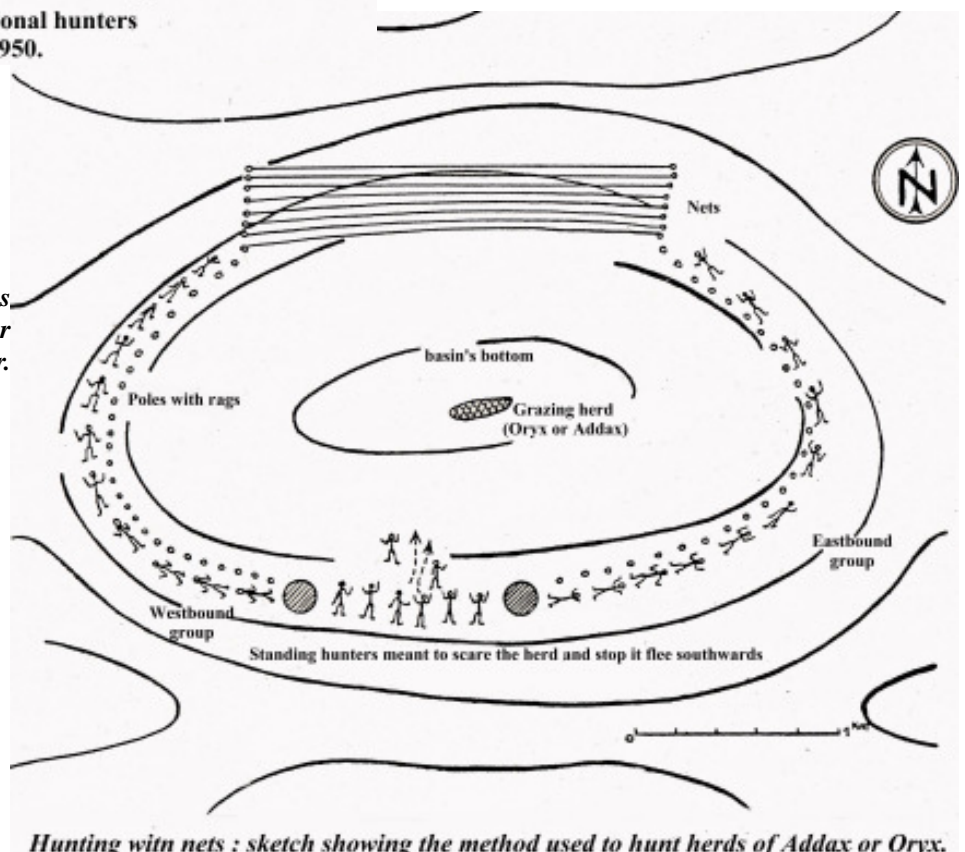
Traditional hunting (Brouin, 1950; Gillet, 1965, 1969; Newby, 1978a, 1978b, 1988; Dragesco-Joffé, 1993), exercised mostly by nomads, with horses and spears, with horses and nets, or, from the Neolithic period on, with bow and arrows, certainly played a role in the disappearance of the species, but probably only from the time when it began to act in conjunction with other factors, and affected already decimated populations.

Taking by sedentary hunters.

Brouin (1950) notes the considerable impact of capture done by traps by non-nomads in the southern part of the range. It is only one aspect of the pressure caused by increased contact with dense human populations progressing northwards.



in G. Brouin. 1950. *Notes sur les ongulés du cercle d'Agadez et leur chasse. Contribution à l'étude de l'Aïr.* IFAN.



Hunting with vehicles.

Of far more significance than traditional hunting, the generalised use of modern firearms and vehicles has been the essential proximal factor of the species extinction. It was mostly carried out by mining, oil extraction, military or administration personnel, African or expatriate (Gillet, 1965, 1969; Newby, 1978a, 1978b, 1988; Hassaballa and Nimir, 1991; Dragesco-Joffé, 1993).

Hunting tourism.

Like for all Sahelo-Saharan antelopes, the slaughter perpetrated by hunting tourism, in particular from the Middle-East, well documented for Sudan (Cloudsley-Thompson, 1992), Niger and Mali (Newby, 1990; Bousquet, 1992), is a potentially major threat.

4.3. Other threats.

All indirect forms of anthropic pressure likely to affect the species, such as the extension of domestic herds, the multiplication of deep wells, and the invasion of available habitats exert pressure through degradation or regression of habitats and increased susceptibility to direct taking. They are treated under the respective paragraphs.

5. REGULATORY PROVISIONS

5.1. International:

Bonn Convention : Appendix I, Resolution 3. 2, paragraph 4.
Washington Convention (CITES): Appendix I

5.2. National:

The Scimitar horned Oryx is totally protected in Algeria, Tunisia, Mauritania, Mali, Niger, and partially in Sudan.



Bas-Drâa. Morocco. 2003
© Marie-Odile Beudels-IRScNB.

6. CONSERVATION MEASURES, BY PARTY

6.1. Ban on taking.

Tunisia (reintroduced in large enclosures within protected areas): protected
Niger (probably extinct): protected
Chad (probably extinct): protected
Morocco (reintroduced in large enclosures within protected areas): protected
Senegal (reintroduced in large enclosures within protected areas): protected

6.2. Habitat conservation

Morocco

The proposed national parks in the lower Drâa basin and the Dakhla region (Müller, 1996) appear to be well suited for the reintroduction of the species, insofar as the Dakhla proposed park extends sufficiently inland to include a substantial representation of steppes and Sahelian woodland which characterised the local range of the species (Valverde, 1957). In both cases, past utilisation of those areas by the Oryx may have been seasonal or non-annual, and the current impracticability to insure secure movements towards other regions may impose a very active management of the habitat, temporary or permanent. The Scimitar-horned Oryx population reintroduced in large enclosures in Souss-Massa National Park counts approximately 240 individuals (Jan. 2005). These animals will be used for reintroduction in former parts of the range.

Algeria

The Tassili des Ajjers National Park and the Hoggar National Parks offer, by their exceptional dimensions and environmental diversity (Bousquet, 1992), obvious reintroduction potential. However, the absence of post-Neolithic observations in these central Saharan massifs, which have been, for thousands of years, mostly at or beyond the limit of aridity tolerable for stable populations of the species, indicates that a reintroduction experiment will almost certainly require habitat rehabilitation and possibly permanent management.



Bou-Hedma NP, Tunisia. 2001. © Roseline C. Beudels-IRScNB

Tunisia

A habitat rehabilitation programme, accompanied by a reintroduction programme, has been conducted in Bou Hedma National Park (Bertram, 1988; Bousquet, 1992; Kacem and *al.*, 1994). Results obtained so far are remarkable, with a present, well-inserted population of 130 animals (Jan. 2005) and a satisfactory reproductive rate (Bertram, 1988; Bousquet, 1992; Kacem and *al.*, 1994). The efforts of the Tunisian authorities to expand the limits of the fenced area on the basis of general consensus must be supported by all means. Bou Hedma NP appears today as the optimal reintroduction site for the species in Tunisia (Bertram, 1988; Kacem *et al.*, 1994), with an adequate habitat of steppes and *Acacia raddiana* woodland, the restoration of which (Karem *et al.*, 1993; Kacem *et al.*, 1994) is a remarkable success, and makes it the best example of this type of habitat in the northern fringe of the Sahara (Bousquet, 1992).

Although Bou Hedma continues to appear today as the optimal reintroduction site for the species in Tunisia, other sites have been sought in order to enhance the dynamism of reintroduction of the Oryx in the northern part of its former range. Early 1999, Sidi Toui National Park (6135 ha fenced) received 15 animals from different European zoos, and Oued Dekouk Nature Reserve (6000 ha fenced) received 3 animals. There are over 30 individuals in Sidi Toui NP nowadays (2005), and 9 at Oued Dekouk NR. Oryx will also be introduced into Dghoumès Nature Reserve (8000 ha) early 2006, and the entire Oryx population in Tunisia will be managed as a single metapopulation in the future (Wakefield & Princée, 2003; Beudels & *al.* 2004).

Mali

The Elephant Faunal Reserve and the Ansongo-Menaka Reserve are located within the recent range of the Scimitar-horned Oryx (Lhote, 1946) and within the part of the range that seems to be particularly favourable for permanent residence. Ansongo-Menaka had a substantial population of Oryx at the time of its creation (Newby, 1982). The two reserves offer good reintroduction potential, but pressures of all types, agricultural, pastoral, residential and cynegetic, to which they seem to be exposed must first be fully controlled (Heringa, 1990; Pavy, 1996). The Elephant Faunal Reserve has good potential, with good tourism perspectives represented by the combination of one of the last Sahelian populations of African Elephant (*Loxodonta africana*) and of a remarkable antelope population (Pavy, 1996). The Tamesna reserve and the proposed strict nature reserves of North Azawagh and South Zdjaret could potentially be of interest for the reintroduction of the Oryx in the future (Lamarque, pers.com),

Niger

The Gadabedji Reserve was created for the Scimitar-horned Oryx. Like the two Malian reserves, it is situated in the optimal climatic zone for the species (Newby, 1982; 1988; Dixon and Newby, 1989; Grettenberger and Newby, 1990). Unfortunately, anthropic pressures have never been sufficiently controlled, and the Oryx became extinct (Newby, 1988; Millington and *al.*, 1991). It remains nevertheless an excellent potential reintroduction site, if those pressures can be alleviated. A habitat rehabilitation programme was undertaken in 1989 (Millington *et al.*, 1991). Another reserve proposed in the Termit region would offer a second possibility. The Termit massif is one of the most intact regions of the Nigerian Sahel, with remaining populations of several ungulates and possibly the last viable Addax population in the world as well as relatively well conserved habitats (Newby, 1982, 1988; Newby and Jones, 1986; Grettenberger and Newby, 1990; Millington *et al.*, 1991). The Air-Ténéré National Park, situated mostly in the Ténéré massif, and which only includes a small part of the eastern slope and piedmont of the Air, appears too arid for the Scimitar-horned Oryx (Newby and Jones, 1986; Newby, 1988).



Herd of Oryx dammah in the «Réserve de Faune du Ferlo Nord» (RFFN). Senegal. 2005. © Abdelkader Jebali. MNHN

Chad

The Ouadi Rimé-Ouadi Achim Gama Reserve is by far the most important site for the reintroduction of the Scimitar-horned Oryx (Gillet, 1965, 1969; Newby, 1974, 1988; Thomassey & Newby, 1990; Dragesco-Joffé, 1993; Pfeffer, 1993a, 1995). The fact that a few individuals were still be living there recently, obviously identifies it as the first conservation priority at global level. The implementation of strict habitat and fauna conservation measures is indispensable. Such measures should be extended to other important areas, such as the North Kanem, the Ennedi and the Tibesti. In the longer term, if populations build up, the richness of the area might allow perspectives of sustainable development by wise use of the large fauna (Grettenberger & Newby, 1990).

Sudan

The proposed Wadi Howar National Park in Darfur might offer possibilities of reintroduction for the Oryx (Hashim, 1996). The conservation status of the steppes and associated woodlands in Sudan (Bari, 1985; Hashim, 1996) suggests that important habitat restoration programmes would be necessary. Efficient control of poaching pressure in large protected areas might however be very difficult to implement (Cloudsley-Thompson, 1992).

Senegal

The North Ferlo Faunal Reserve (Bille *et al.*, 1972; Bille and Poupon, 1972; Sournia and Dupuy, 1990), established in 1972, covers an area of 487.000 ha and offers good reintroduction possibilities (Diop *et al.*, 1996; Clark, 1996). A reintroduction programme was started in 2003 with 8 Scimitar-horned Oryx, from Israel, in a 600 ha enclosure, after a sojourn in Guembeul. There are now 23 individuals in the Ferlo (October 2005), still confined to the 600 ha enclosure (Jebali, A. 2005). Its success will rely, mostly, like for every southern Sahelian site, on the feasibility of limiting human pressures, in order to protect the fauna and allow the vegetation to regrow (Diop and *al.*, 1996).

Burkina Faso

The Sahel partial faunal reserve could become the nucleus of a reintroduction zone in the Sahelian Burkina Faso. The reserve has been seriously affected by overgrazing, woodcutting and droughts (Heringa *et al.*, 1990).



6.3. Attenuation of obstacles for migratory animals

Given the present state of the populations, the question has no object. In the case of a recuperation of numbers, or progressively as reintroduction projects succeed, it gradually could arise more and more. In the short and medium term, only the creation of protected areas which are sufficiently vast to include the entire necessary range, and in particular, cross-border reserves, seems to be an adequate answer. It appears indeed improbable that the security of movement between protected areas can be assured in a realistic manner in the foreseeable future.

6.4. Regulations concerning other detrimental factors.

For reasons exposed under 6.3, such rules have meaning only in the framework of protected areas management plans. This paragraph therefore merges with paragraph 6.2.

6.5. Other measures

Morocco

The Oryx reintroduction programme is well under way in Morocco. A population of some 240 individuals is now available in a large enclosure within the Souss-Massa National Park. On the basis of this well established herd, plans are being developed to reintroduce the species in its former range, in suitable areas such as the lower Drâa valley.

The Oryx reintroduction programme is highly successful so far in large enclosures in Bou Hedma National Park, which is situated within the historic range (Bertram, 1988; Bousquet, 1992; Gordon and Gill, 1993; Kacem *et al.*, 1994). A project initiated in Sidi Toui National Park and Oued Dekouk Nature Reserve in early 1999, is equally successful. Further steps towards reintroduction will be taken in 2006 with animals introduced into Dghoumès Nature Reserve and general management of the total tunisian population as a single metapopulation.



© Renata Molkanova



© Tania Gilbert. Marwell Conservation Trust.

Calf of Oryx dammah. Sidi Toui NP. & Bou-Hedma National Park. Tunisia.



Oryx dammah. Souss-Massa NP. Morocco. © Marie-Odile Beudels- IRScNB

Niger

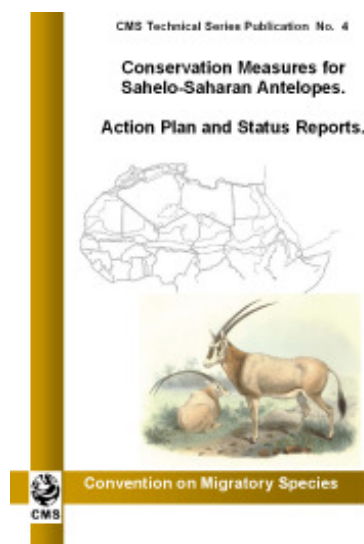
A semi-captive raising programme is being envisaged at Gadabedji, with an objective of possible reintroduction in appropriate areas (CMS/FFEM, 2004).

Senegal

A reintroduction programme in the Ferlo reserves, with preliminary acclimatisation in the Gueumbeul Sahelian wildlife reserve is being developed (Diop *et al.*, 1996; Clark, 1996; Jebali, 2005).

Outside range

Captive or semi-captive herds or individuals can be found in several countries. There are over 1500 individuals in 93 institutions spread over the entire globe. This include North and South America, Australasia, Europe, Japan, South East Asia, North Africa, South Africa and the Middle East. This figure does not include the several thousand animals held in private ranches in Texas and the Middle East (Newby, 1979; Gilbert & Woodfine, 2005).



7. RESEARCH ACTIVITIES

7.1. Public authorities.

Tunisia: monitoring of reintroduction activities in Bou Hedma and elsewhere.

7.2. N.G.O

8. NEEDS AND RECOMMENDED MEASURES

Recommended measures are detailed in ASS-CMS Action Plans (Beudels *et al.*, 1998). The principal needs that they meet are listed below.



Oryx. Bou-Hedma NP. Tunisia. © Tim Woodfine. Marwelle Preservatio Trust

8.1. Total protection of the species

Necessary in all the countries of the historical range to prepare for a possible reoccupation of the species.

8.2. Conservation measures.

Establishment of a network of protected zones in all parts of the historical range, based on the guidelines of paragraph 2.1.4., with absolute priority given to zones where the species last occurs in the wild, specifically, firstly, the Ouadi Rimé-Ouadi Achim Reserve in Chad, secondly, Niger.

8.3. Location and monitoring of residual populations, and definition of their ecological requirements.

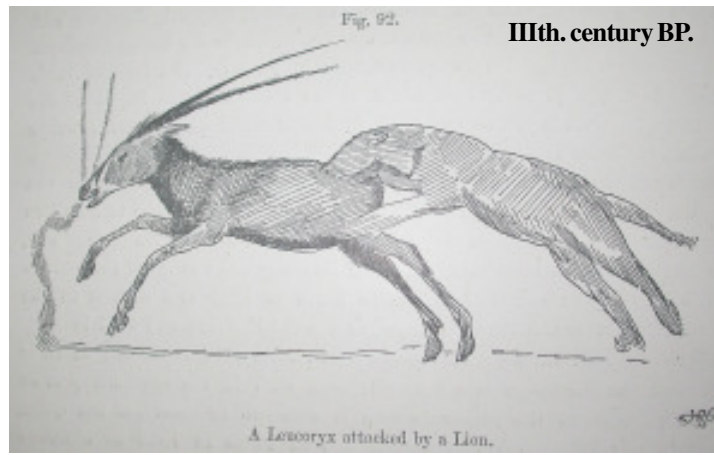
Determined search for residual populations, firstly in Chad, secondly in Niger.

8.4. Reinforcement and/or reintroduction of populations in the potential range.

Support to reintroduction programmes in Tunisia, Morocco and Senegal. Preparation of programmes in other parts of the range, following the guidelines of paragraph 2.2.4.



*Archives from the 70's : Ouadi Rimé-Ouadi Achim Game Reserve. Chad.
Oryx escaped, leaving the Ouadi Achim ; Oryx tracks near Citrullus colocynthis ;
an exhausted adult ; abandoned calf. © John Newby*



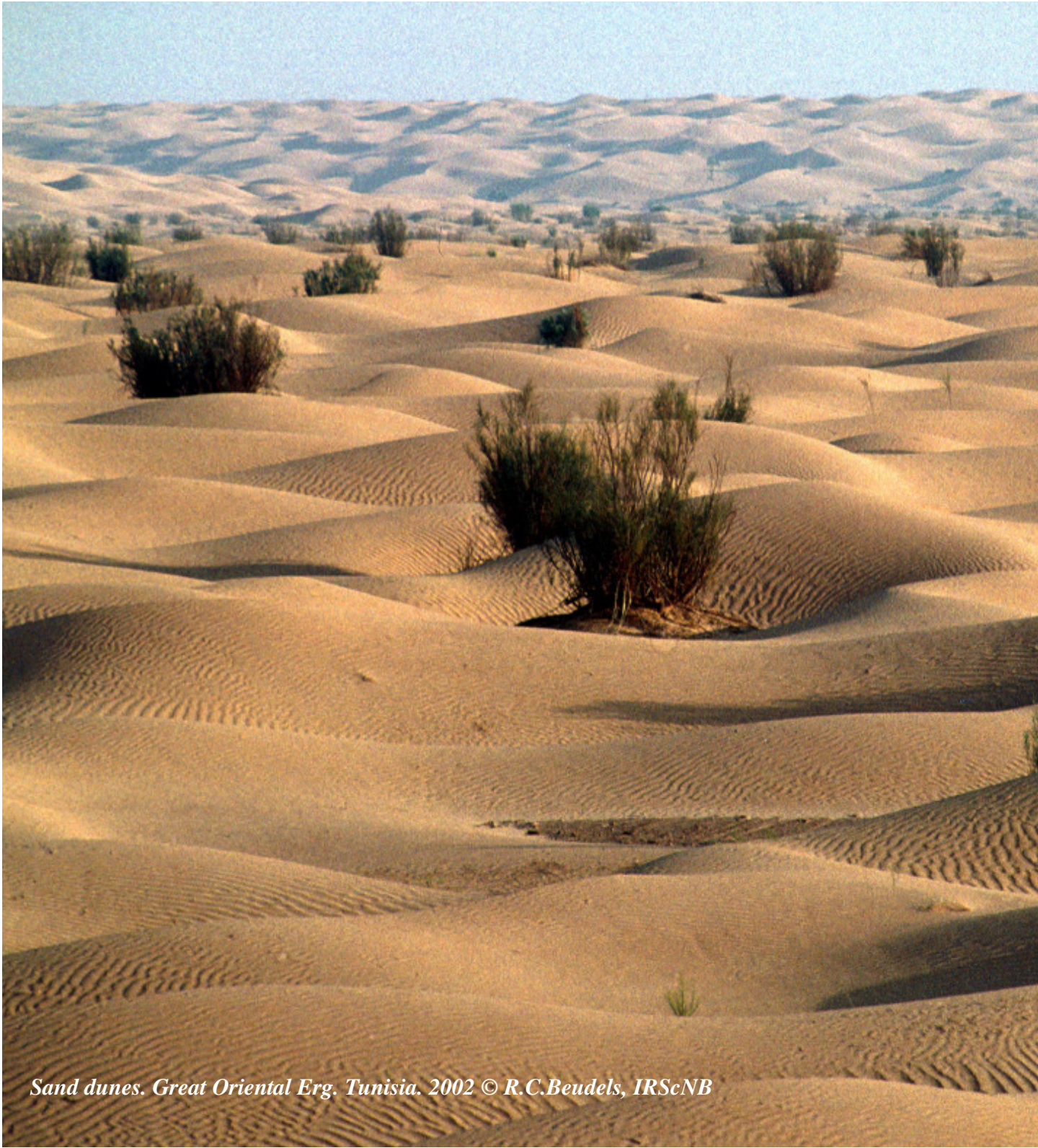
Oryx attacked by a lion. Sketch made in 1890 by Sir Harry Johnston from a mosaic. Bardo Museum - Tunis. in Sclater, P.L. & O. Thomas, 1899.



Oryx. North Kanem. Chad. in R. Malbrant, 1952. © Jarty



Oryx. Oued Dekouk NP. Tunisia. © Roseline C. Beudels-Jamar-IRScNB.



Sand dunes. Great Oriental Erg. Tunisia. 2002 © R.C.Beudels, IRScNB

Addax nasomaculatus



**Roseline C. Beudels-Jamar, Pierre Devillers, René-Marie Lafontaine and John Newby
Institut royal des Sciences naturelles de Belgique**



*A herd of Addax in the desert in 1871. North-East of Termit. Niger.
From Nachtigal, G. 1879. Sahara and Sudan, Vol. I. Weidmannsche Buchhandlung, Berlin*

Previous drawing : Addax nasomaculatus. J.Smit in Sclater & Thomas, 1899



Addax nasomaculatus

1. TAXONOMY AND NOMENCLATURE

1.1. Taxonomy.



Addax. Female.Termit.1998. Niger.
© Cdt Hama A. Souleymane-DFPP-Niger.

Addax nasomaculatus belongs to the tribe *Hippotragini*, sub-family *Hippotraginae*, family *Bovidae*, which comprises one extinct species, seven surviving species, and two evolutionary distinct subspecies in genera *Oryx*, *Addax* and *Hippotragus* (Simpson, 1945; Murray, 1984; Corbet et Hill, 1986; Wachter, 1988). All hippotraginids are adapted to the exploitation, generally at low density, of difficult, low-productivity habitats (Kingdon, 1982; Murray, 1984; Wachter, 1988; Beudels, 1993). The genus *Addax* is comprised of a single species, adapted to the desert.

1.2. Nomenclature.

1.2.1. Scientific name.

Addax nasomaculatus (De Blainville, 1816). Described as *Cerophorus nasomaculata* de Blainville, 1816. Bull. Sci. Soc. Philom. Paris, 1816:75. Type locality: None given. Lydekker

(1914:148) stated it was “probably Senegambia”, but Grubb (2005) noted that it was more probable that British hunters or collectors obtained *Addax* from the Tunisian Sahara, to which he restricted the type locality.

1.2.2. Synonyms.

Antilope nasomaculatus, *Antilope addax*, *Addax nasomaculatus addax*, *Antilope naso-maculata*, *Cerophorus nasomaculata*, *Antilope suturosa*, *Antilope mytilopes*, *Antilope gibbosa*, *Oryx addax*, *Oryx naso-maculatus*, *Addax suturosus*, *Addax addax*

1.2.3. Common names.

English : Addax

French : Addax, Antilope addax, Antilope de Mendès

German: Mendes Antilope

Arabic : Begaar el Ouach, Akash, Abu-Akach, Anjidohl, Auel, Bakra el onash, Tamita

Tamashek: Amellal

Toubou: Turbo

1.2.4. Description.

A predominantly white, stocky-bodied, medium-sized antelope inhabiting the sand seas and gravel plains of the Sahara. Head light grey or beige, with contrasting white patches in front of the eyes, linked across the bridge of the muzzle. Small white patches behind the eyes. Nose beige, lips and chin white. Crown and forehead sporting a prominent, wig-like tuft of dark brown hair. Ears white with a long basal tuft of pale hairs. With the exception of the throat and chest, which are beige, overall body colour is bright matte white. During the hot season (Apr-Oct), pelage is short, but in the colder months (Nov-Mar) it lengthens on the neck, chest, shoulders, back and flanks, becoming greyer, a characteristic especially obvious in *Addax* held in zoos with cold winter climates (Renshaw, 1902). Adults of both sexes develop a

beige fringe of variable length on the lower neck. Old adult males can develop a dark brown front coat (Ascani, pers. comm). Legs white with beige patches on the knees. Hooves broad and splayed. Tail short and white, sporting a sparse tuft of dark terminal hairs. Other than slight differences in size, weight and horn development in adults, sexes essentially similar. Nipples: 2 + 2 = 4.

Both sexes bear corkscrew shaped horns, which grow upwards and outwards, reaching over one metre in length. The horns of the adult male are stockier than those of the female, often having two to two-and-a-half turns to the female's one-and-a-half to two. Horns heavily annulated over the first two-thirds of their length in both sexes. Over time, and with violent sparring, the horns of the male may become lost, damaged or blunted.

The Addax probably takes its name from the vernacular Arabic 'agas or 'adas. The specific name *nasomaculatus* - meaning 'spotted nosed' - refers to the contrasting white patches on the otherwise darker head.

TL: 125 - 170 cm

T: 30 - 32 cm

H: 105 - 115 cm

weight: 70 - 150 kg

horns: 65 - 109 cm



2. BIOLOGY OF THE SPECIES

2.1. General Biology

2.1.1 Habitat.

The main, Saharan, range of the Addax, corresponds to the desert formations of White (1983), including the desert dunes with perennial vegetation of his unit 70 together with the regs, hamadas and wadis of his unit 71. It also extends to White's unit 54, which contains the grassy and shrubby formations of the northern Sahel, entered by Addax in search of pastures during periods of drought.

The Addax is well known for its utilisation of extremely desolate, inhospitable, and arid habitats (Dragesco-Joffé, 1993). It has anatomical, physiological, and behavioural characteristics which allow it to exploit habitats where life seems impossible (Lavauden, 1934; Bourgoïn, 1955; Gillet, 1965; Newby, 1974). A specialist of sandy desert regions, the Addax is the characteristic occupant of Saharan dunes, adapted to very dispersed pastures (Heim de Balsac, 1936; Malbrant, 1952; Gillet, 1969; Newby, 1984; Grettenberger and Newby, 1990; Dragesco Joffé, 1993).

The precise data available on the habitat of *Addax nasomaculatus* have been gathered in Chad (Malbrant, 1952; Gillet, 1965, 1969; Newby, 1974; Dragesco Joffé, 1993), in Niger (Lhote, 1946; Grettenberger and Newby, 1989) and in Mauritania and Mali (Lamarche, 1980, 1987). The conjunction in the southern Sahara of the extreme extension of tropical summer rains and of sporadic winter depressions of Mediterranean origin allows, in favourable years, a year-round production of green pastures by plants that react to both phenomena (Gillet, 1969). The plants capable of greening with the passage of humid air linked to the northward shift of the tropical front, are precisely those which provide the basic food of the Addax, in particular the drinn (*Aristida pungens*), *Aristida plumosa*, the had (*Cornulaca monacantha*), plants of broad distribution reaching far north into the desert (Gillet, 1965).

In the southern part of its range at least, during the dry season, Addax approach areas of human occupation in the south, their distribution then being determined by the presence of wild melons, *Colocynthis vulgaris* (*Citrullus colocynthis*), particularly characteristic of sub-desert Sahelian steppes and representing for the species the principal source of water at this time of year (Newby, 1974; Dragesco Joffé, 1993). As soon as the first rains renew their Saharan pastures, Addax return rapidly to the security of their remote grazing grounds. Newby (1974) shows that, in Chad, the southern limit of Addax during the rainy season corresponds approximately to the southern limit of had (*Cornulaca monacantha*), a chenopodid shrub that is a good source of water.

In the ephemeral pastures of the rainy season, the Addax feeds on graminids such as *Aristida pungens*, *Stipagrostis plumosa*, *Tribulus sp*, *Cyperus conglomeratus*, young green leaves of *Panicum turgidum*, and a variety of leguminous





Chad. sandsheet with Cornulaca

70'. Addax. Issaouane. Niger. © John Newby

plants such as species of *Tephrosia* and *Indigofera*. During recent periods of drought, Addax have survived by grazing mainly on the perennial grass *Stipagrostis vulnerans*, which is usually only consumed in the dry season (Newby, 1974). Other plants utilised by the Addax in the dry season are the Apiaceae *Schouwia thebaica*, the Amaranthaceae *Aerva javanica* and the Euphorbiaceae *Chrozophora brocchiana* (Newby, 1974), or grasses like *Aristida acutiflora* (Dragesco Joffé, 1993).

The Addax can go without water for very long periods (Malbrant, 1952; Gillet, 1965, 1969; Newby, 1974; Dragesco Joffé, 1993), as noted, in particular, in Niger (Lhote, 1946; Grettenberger and Newby, 1989). Some plants having surface hair or glands capable of trapping night-forming dew, such as *Tephrosia vicioides*, are very sought after by the Addax (Gillet, 1965). It seems that the Addax can make use of viscous liquids at high osmotic pressure secreted by several plant species that it consumes (Gillet, 1969).



Citrullus colocynthis. Niger. © John Newby

One of the main types of Saharan pastures is the “gizu” or “jizzu”, ephemeral pastures that form after occasional rains, without which the Addax could probably not survive (Wilson, 1978; Newby, 1984). The combination of cool winter nights and good water retention of the soil allows the pastures to remain green until summer. The animals that graze on the gizu can stay almost indefinitely independent from waterholes (Newby, 1984). The main elements of gizon are *Indigofera berhautina*, *I.hochstetteri*, *Neurada procumbens*, *Tribulus longipetallus*, *Fagonia bruguieri*, *Cyperus conglomeratus* and *Stipagrostis acutiflora* (Newby, 1974, 1984; Wilson, 1978).

2.1.2. Adaptations

The Addax displays a large number of morphological, physiological and behavioural adaptations to life in a hot, dry environment, including pale colouration to reflect radiant heat, pelage length and density to assist with thermoregulation, barrel-bodied shape to reduce surface area/volume ratio, and large, splayed and spongy hooves for moving in a hot and sandy environment. They also have a highly efficient moisture extraction and retention system.

Behavioural adaptations include feeding during cooler hours and at night, and sheltering and resting during the heat of the day. Seasonal distribution and frequentation of traditional sites are often influenced by presence of shade (Newby 1981). Excavation of shelter behind vegetation or on the shade side of dunes with both hooves and horns have been recorded (Lamarche, 1980; Dragesco-Joffé, 1993).

2.1.3. Social behaviour

Addax generally live in small herds of up to 15 animals, composed of males and females of all ages (Lhote 1946, Lamarche 1980, Walters 1981, Mackler 1984). The larger groups observed in the past, sometimes numbering several hundreds, were probably the result of many smaller herds congregating seasonally and temporarily in areas of exceptional grazing (Nachtigal 1881, Lavauden, 1926, In Tanoust 1930, Newby 1978, Monod 1990). With increasing persecution, and as a result of mortality due to the severe droughts of the past four decades, average Addax herd size today is rarely more than half a dozen individuals (Dragesco-Joffé 1993). In Niger, between 1980 and 1991, average herd size was 2.2 (range=1-5; n=27) (Rapant 1992, Poilecot 1993).

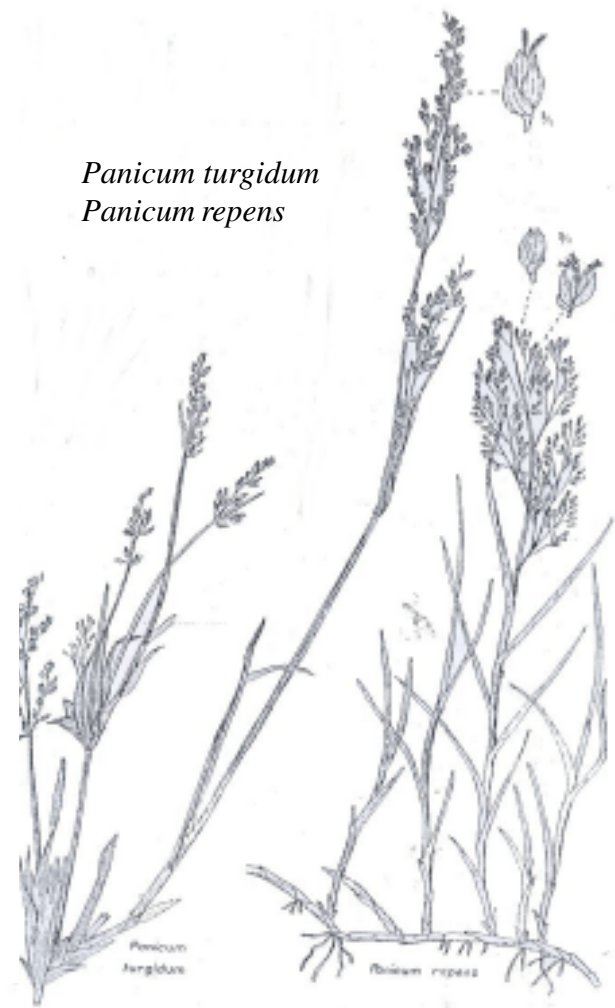


Addax, adult and calf. Souss-Massa National Park. Morocco. © Fatima Oumzai. Service Forestier Morocco



Cornulaca monacantha

Panicum turgidum
Panicum repens

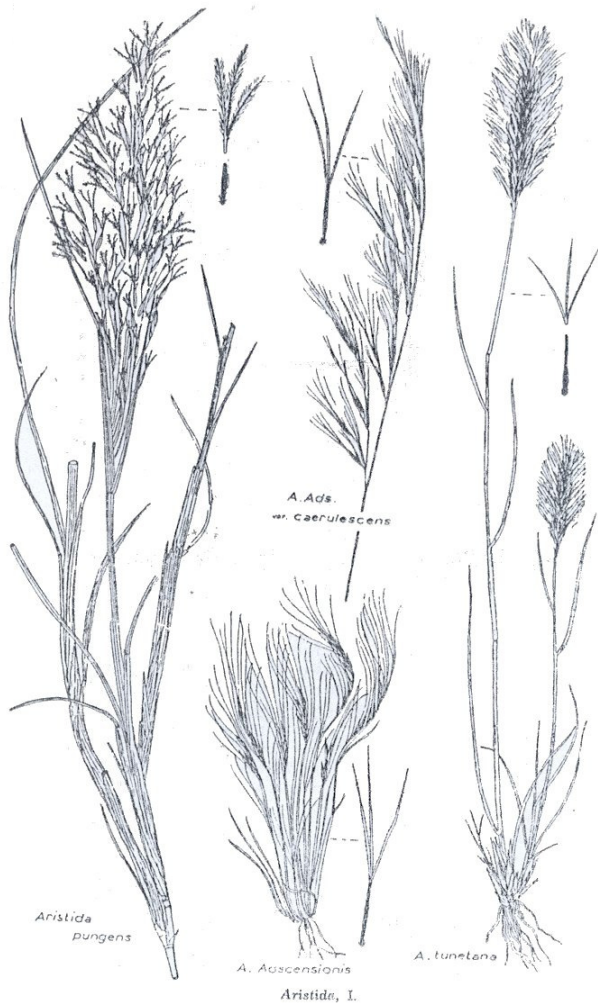


Retama retam

“Flore et végétation du Sahara”
by Paul Ozenda, copyright
CNRS EDITIONS, 2004 Paris.

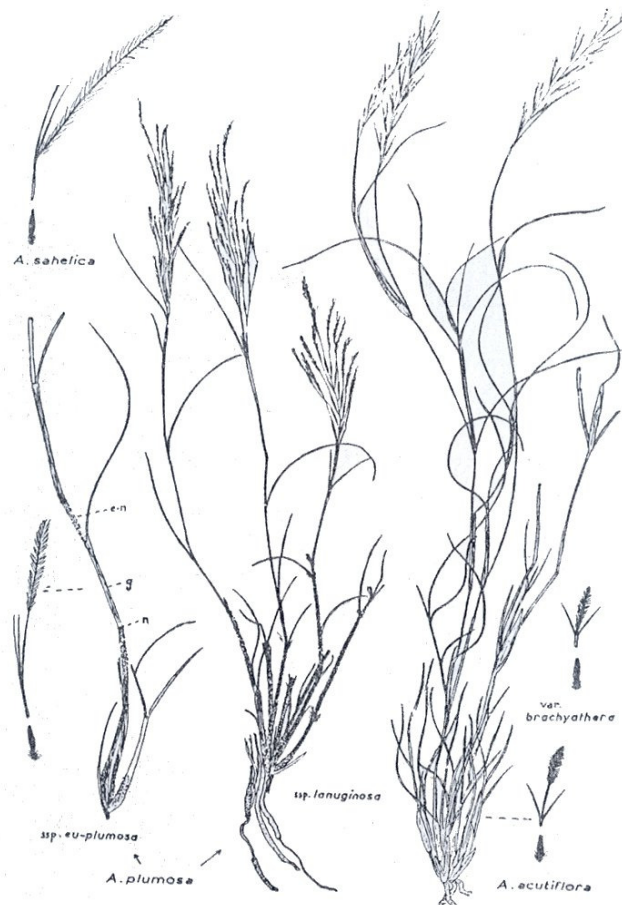
— Retama

Pour *R. retam*, on a représenté une branche fleurie et une branche fructifiée, et pour *R. sphaerocarpa*, un fragment de rameau à chaque état.



Aristida

FLORE DU SAHARA



— *Aristida* (fin). Voir légende de la figure 31

“Flore et végétation du Sahara”
by Paul Ozenda, copyright
CNRS EDITIONS, 2004 Paris.

2.2 Distribution.

2.2.1. Historical distribution.

The historical range of permanent or periodical presence and movements of the Addax encompasses all of desert and sub-desert North Africa between the Atlantic and the Nile. Within this range, the distribution of the species is conditioned by that of large zones of ergs and sandy regs (Lhote, 1946; Schnell, 1977; Quézel, 1965; White, 1983; Walter and Breckle, 1986; Le Houérou, 1986; Grettenberger and Newby, 1990; Ozenda, 1991; Kacem *et al.*, 1994), of temporary pastures (Grettenberger and Newby, 1990; Dragesco Joffé, 1993), and of ecotones between the sub-desert steppes and the desert (Gillet, 1969; Newby, 1974).



Touffe de Hadd et traces d'Addax balayées par les vents
© John Newby

The Addax is a species of the true desert, adapted to very dispersed pastures (Heim de Balsac, 1936; Gillet, 1969; Newby, 1984; Grettenberger and Newby, 1990; Dragesco Joffé, 1993). The distribution seems to have been organized in a number of large ensembles between which exchanges were probably possible.

In the west, a large body of data identifies populations linked to the great Mauritania-Malian ergs of the Majabat al Koubra and to the Iguidi and Chech ergs (Monod, 1958; Gillet, 1969; Trotignon, 1975; Walter and Breckle, 1986; Lamarche, 1987). It is probably these populations which occupied, with an unknown regularity, the Atlantic Sahara in the region of Dakhla (Morales Agacino, 1950; Valverde, 1957; Loggers *et al.*, 1992) and gave way to observations east of Zagora in the region of the upper Drâa in Morocco (Marçais, 1937; Loggers *et al.*, 1992).

More to the east, substantial zones of presence are centred on the Grand Erg Occidental (Gillet, 1969; Kowalski and Rzebik-Kowalska, 1991), the Grand Erg Oriental (Lhote, 1946; Gillet, 1969; Kowalski and Rzebik-Kowalska, 1991; Kacem *et al.*, 1994), the large sandy zones (Walter and Breckle, 1986) of the Hamada de Tinrher and the southern part of the Hamada el Hamra (Lhote, 1946; Gillet, 1969; Hufnagl, 1972; Kowalski and Rzebik-Kowalska, 1991), and the entire piedmont of the Hoggar and the Tassili des Ajjers, in particular in the Erg Admer (Lhote, 1946; Gillet, 1969; Kowalski and Rzebik-Kowalska, 1991). Beyond, in Libya, the data, relatively few and dispersed, suggest a possible presence in the piedmont slopes of the Haruj al Aswald, in the region of Koufra, and in the vicinity of the Calanshio Sand Sea (Hufnagl, 1972). In the Western Desert of Middle Egypt, the Addax was known from large oases and depressions or their periphery, in particular from Siwa in the northwest and from the Libyan oasis adjacent to Jaghub, from the depression of Qattara, from Faiyum, from Bahariya, from Farafara, from Dakhla, and from the Kharga complex (Osborne and Helmi, 1980). It was noted also in the extreme northeast of the Mediterranean coastal desert, in the Nubian Desert southwest of Bir Kiseiba, and in the region of the Jebel Uweinat.

In the transition zone between the desert and the Sahelian steppes, regions of significant presence of the Addax existed at least in the periphery of the Adrar des Iforas (Lhote, 1946), in the Ténéré, in the foothills of the Aïr, and in the Termit massif (Lhote, 1946; Brouin, 1950; Grettenberger and Newby, 1990; Millington *et al.*, 1991), in northern Chad south of the Tibesti (Gillet, 1969; Newby, 1974), in the Sudano-Chadian regions of the Mourdi depression and Wadi Howar (Gillet, 1969; Kock, 1970; Wilson, 1980), in the Nubian Desert of the Northern region and of northern Kordofan in Sudan (Kock, 1970). The southern limit of the main range of the Addax is located between 17° and 19° N in central northern Mauritania, between 17° and 19° N in central Mali, at 16° N in Niger, at 15° N in Chad, and at 14° N in Sudan. It is situated in the semi-desert Sahelian steppe belt of White (1983). During the hot season, the Addax may migrate south into the Sahelian zone in order to meet the first showers and rain-generated pastures.



Addax poached by soldiers in the 70'.
Quadi Rimé-Ouadi Achim Game Reserve. Chad. .
© Jon Newby



Available data indicate that the historical distribution of the Addax was relatively continuous over the entire Sahelo-Saharan region.

2.2.2. Decline of the range.

Like that of the Oryx, the range of the Addax has regressed continuously since the drying up of the Sahara (Gillet, 1969). During the entire Neolithic Age, it was at least as abundant as the Oryx in all of North Africa (Gillet, 1969). Like the rest of the Saharan fauna, the Addax suffered from the effects of increased aridity, but it found refuge on the periphery of the desert (Gillet, 1969). This was a very temporary refuge, as the Addax, like the rest of the large North African fauna, underwent massive taking during the Roman era (Le Houérou, 1986; Newby, 1988).

The Addax was still widespread throughout the Sahara around 1840 (Dragesco-Joffé, 1993). It had completely disappeared from the northern Sahara and its fringes by the end of the 19th century (Newby, 1986; Kowalski and Rzebik-Kowalska, 1991; Loggers *et al.*, 1992). The decline accelerated as of the beginning of the 20th century, and even more during the period between the two world wars (Gillet, 1969). The rapid decline of the Addax coincided with colonisation, oil prospection, and the militarisation of the desert (Gillet, 1969; Dragesco Joffé, 1993). The increase in off-road vehicles allowed a much more efficient penetration into the remotest regions. The Addax is particularly sensitive to disturbance; it gallops until exhaustion if chased (Dragesco Joffé, 1993). Narratives recount how entire herds were destroyed in a single hunt (Lhote, 1946; Gillet, 1969). The intense periods of drought and the desertification that they have generated these last decades (end of the 1970's and early 1980's) have clearly contributed to the general decline of the species (Newby, 1989).



Towards the end of the 19th century, explorers in Central Sahara all described the abundance of gazelles and Addax in the Tassili (ameïlal in tamâhaq), in the vicinity of dunes formations in particular. Over-hunting drove this beautiful species to extinction in that area
HACHID, M. 2000. Tassili N'Alger.

Photo taken in 1946 and published in : GAUTHIER, E.F. 1950. Le Sahara. Payot, Paris.



Addax horn. Tin Toumma.Termit. Niger. 2004 © Tim Wacher - ZSL



Addax tracks. Ouadi Rimé-Ouadi Achim. in the 70'. Chad. © John Newby



Addax horn. Niger. 2004 © John Newby

Up until the 70', the Addax was still widespread and locally abundant in the centre and the south of its range (Newby, 1986). Like that of the Oryx, the decline of the Addax was spectacularly rapid everywhere. In one generation, the Addax lost 90% of its range (Newby, 1986).

Table 1. Current status and dates of probable extinction of the Addax in range states, according to Newby (1984) or other authors as indicated.

Country	Current status of the Addax (probable date of extinction)	Late observations (possibly of vagrant individuals)
Morocco	extinct	1963 (1 individual) vagrants?
Ex-Spanish Sahara	extinct (1942)	
Algeria	extinct?	
Tunisia	extinct (1932) (Kacem, 1994)	
Libya	extinct (end of the 1960's)	
Egypt	extinct (around 1900)	
Sudan	very rare, extinct?	
Chad	endangered	
Niger	endangered	
Mali	endangered	
Mauritania	endangered	



in Brockelhurst, 1931.

2.2.3. Residual distribution.

The current range of the Addax is reduced nowadays to a few very small pockets, highly fragmented, distributed over two or three regions across Southern and Central Sahara :

- In the massif and erg of the Termit-Tin Toumma survives what is probably the only viable population of Addax today, around 200 individuals (Wacher *et al.*, 2004).
- Further East, towards the border with Chad, in the regions of Agadem (Niger), North Manga and Eguey (Chad), solitary animals or very small groups are sometime observed (Newby, SCF communication, Sept 2005).
- West of termit, towards the Air Mountains (Niger) and northwards to the border with Algeria, there have been sporadic but no really good reports of Addax over the past few years (Newby, SCF communication, Sept. 2005).
- To the West, the Majabat-alKoubra desert, between Mauritania and Mali, has, far long time, been considered by several authors to be a key area for Addax survival (Lamarche, 1987; Dragesco Joffé, 1993). This area has never been formally censused Today, if it is still possible that a population of addax survives in the Majabat-al-Koubra, there is no data available or numbers nor trends. Moreover, the region is nowadays highly insecure and the implementation of Conservation measures very unlikely.

2.2.4. Recolonisation prospects.

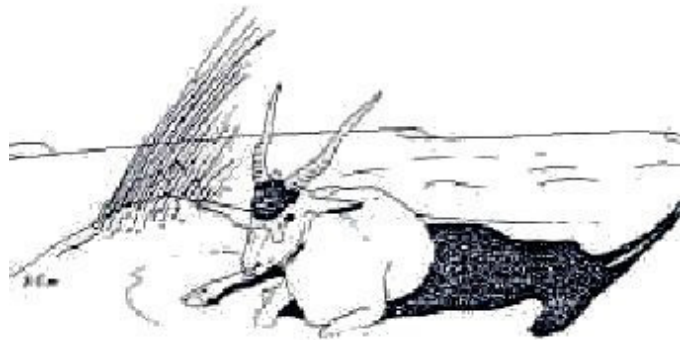
Any prospect of recolonisation of the Addax must necessarily integrate, on the one hand, new attempts at in situ conservation of the Addax and its habitat, and, on the other hand, attempts at reintroduction or reinforcement of populations from individuals born in captivity, in parallel with measures of habitat management. The techniques of reinsertion in the wild of captive-born animals are relatively well mastered today for antelopes, and there are more than a thousand Addax currently in captive herds, around the world.

The chances of recolonisation are perhaps better for the Addax than for the Oryx. The species is capable of living in extreme habitats which man and his livestock cannot use, and it has a reproductive strategy that allows it to rapidly exploit favorable climatic conditions. The potential range of the Addax is the desert and the sub-desert. Its distribution within desert regions does not seem to have limits other than the periodic carrying capacity of temporary pastures dependant on a pattern of sporadic precipitation. The Addax roams in a region reached, although in attenuated form, by tropical summer rains at their extreme extension, and also, sporadically, by winter storms of Mediterranean origin that cross the Sahara in its southern part (Gillet, 1965). Towards the desert, the limit of its range corresponds to that of availability of feeding grounds. Towards the Sudanese regions, the limit of the range, reached by the Addax during dry periods, situated near the 15th parallel in the driest years (Gillet, 1965), is probably set by competition with other species, domestic livestock in particular.

Newby (1989) believes that the decline of the Addax in Niger over the last 50 years can be attributed essentially to three determinant factors: direct taking (hunting and poaching), drought and disturbance by tourism. According to his 1989 analysis, the influence of hunting and disturbance caused by tourism should be decreasing in Niger. Consequently, even taking into account the fact that in certain areas and for certain types of habitat the recent periods of drought most certainly caused irreversible damage, Newby considered that, in 1989, prospects for conservation and reintroduction projects were probably better than they had been in the preceding decade.

In situ conservation measures : measures that need to be sustained or initiated to improve the perspectives of recolonisation in a number of Range States, as follows:

Niger. A proposed reserve in the Termit region would offer the only possibility to save the Addax *in situ*, and it should be supported and implemented. The Aïr-Ténéré National Nature Reserve, created in 1988 for the conservation of Sahelo-Saharan antelopes, has suffered these last years and human presence has never been sufficiently controlled (Newby, 1988), but the size of the reserve (77,360 km²) and the Addax sanctuary that it encloses constitute an important asset.



*Young female tucking shade behind a Aristida pungens.
Twama. Mauritania. Dec 79
B. Lamarche. 1980*

Chad. The rehabilitation of the Ouadi Rimé-Ouadi Achim Reserve is a national and international priority for the restoration of the Oryx and the Addax. Prospections will need to be undertaken urgently in North-Eastern Chad, in the Mourdi depression, North Ennedi and Erdi, and the North-West, in the North Manga and Eguey, near the border with Niger.

Mali. The establishment of a protection area specifically for the Addax in the Majabat al Koubra could be studied. The Adrar des Iforas is also a potentially important region. Field prospection must be conducted in the area, with a view to concrete proposals.

Mauritania. The possibility of implementing the proposal of a Tilemsi reserve (Hamerlynck, in litt.) near Oualata and Tichitt, or another protection area in the Mreyyé needs to be studied. The control of hunting is in any case crucial to any conservation efforts in Mauritania.

Libya. Prospections should be made in the South West of the country.

Sudan. A proposal for creating a reserve exists for the Wadi Howar. There are no available data on the presence of a residual population of Addax in the area.

Population reinforcement or reintroduction measures : the following measures are either based on existing activities or represent new proposals; these actions must accompany the above *in situ* conservation measures in the same or additional Range States, as follows:

Tunisia. The essential Tunisian Addax reintroduction programme, so far very successful in its establishment of a viable and successfully-reproducing herd of about 45 animals at Bou Hedma National Park, must be assisted in its progress and supported internationally. In particular it must be helped to proceed to the crucial stage of reimplantation of the species in more typical, Saharan, habitats. This has long been foreseen by Tunisian authorities, but requires complex preparatory management measures in southern Tunisian protected areas, in particular Djebil National Park (2006).

Morocco. An Addax restoration programme is underway, which must be supported. The prospects of reimplantation of the Addax the proposed National Park of Dakhla-Adrar Souttouf are good.

Niger. A programme to reinforce the Addax population in Aïr-Ténéré was studied in detail at the end of the 1980's (Dixon, Knowles and Newby, 1989); it would be reevaluated and updated in the current environmental and socio-economic context.

Chad. An evaluation of the necessity and feasibility of a population reinforcement programme is needed.

Algeria. The existence of national parks of exceptional dimensions, the Tassili des Ajers National Park and the Hoggar National Park, could be an important favourable element for the restoration of the Addax in Algeria.

Libya. The Zellaf Reserve, in the southern part of the Hamada el Homra, could be considered for a future restoration of the Addax in Libya.



2.4. Evaluation and evolution of populations.

Although there is no estimate of the size of Addax populations in the 19th century or before, it appears that the species was widespread in Antiquity (Lavauden, 1926). Most authors agree that the species was formerly common and locally abundant in its entire range (Sclater Thomas, 1899-1900; Chudeau, 1920; Heim de Balsac, 1931; Harper, 1945; Lhote, 1946; Monod, 1958; Le Houérou and Gillet, 1986; Lamarche, 1987; Newby and Magin, 1989).



In 1966, estimates of total numbers of Addax surviving in the wild were of the order of 5000 individuals (Dolan, 1966). Around 1980-1981, Newby (1981) estimated that the total number for the species had decreased to fewer than 4000 individuals, and to fewer than 2000 individuals in 1986 (Newby, 1986). Today, taking into account the latest prospections and inventories on the basis of statistical extrapolation of the latest field observations, and taking into account all other information sources as explicated in & 2.2.3., the total world population of Addax is estimated at 200-400 individuals (SCF-SSIG, 2005). Today, it appears that the last viable population of Addax in the world is the Termit-Tin Toumma population in Niger.

Addax habitat. Niger. Tin-Toumma and Termit
© John Newby-SSIG-SCF mission 2004

2.5. Migration.

The Addax is described by several authors as being in perpetual movement, like a tireless nomad who roams large areas in search of pastures and which exploits environments where all life seems impossible, such as the ergs and the regs (Gillet, 1965, 1969; Lamarche, 1987; Dragesco Joffé, 1993). Because of the erratic character of Saharan rains, the Addax lives in regions where grassy clumps are extremely dispersed, making it necessary to perform large daily movements (Gillet, 1967; Newby, 1984). In addition to local movements made throughout the year, numerous authors have described annual migratory movements, with a penetration in the desert at the time of rains and during the cool season, and a reverse movement, towards the periphery of the desert, in summer (Newby, 1984). These movements are closely linked to the search for shade and, above all, to the absolute need to consume plants capable of satisfying both the nutritional and water needs of the species (Newby, 1984); they thus vary considerably from year to year, although they are not unpredictable (Newby, 1974).

Annual movements were described for Chad and Niger by Gillet (1965, 1969) and Newby (1974), for Mali and Mauritania by Monod (1952) and Lamarche (1980, 1987), and for Sudan by Wilson (1980). Gillet (1969) and Newby (1974) compare, in Chad, the seasonal migrations of the Oryx and of the Addax and note that these seasonal movements are of a lesser amplitude for the Addax than the Oryx (Newby, 1974) and stay almost always in a more northerly position (Gillet, 1969).

At the end of the dry season, the Addax moves well into the sub-desert Sahelian steppes, between the 15th and 17th parallels, and in very dry years descends as far as the 14th parallel (Newby, 1974). In Chad, Gillet (1965) distinguishes between populations which make regular movements, populations which are relatively sedentary, and individuals or small groups that perform large amplitude but erratic movements.

Cyclic migrations, seasonal or interannual, of Addax have, or had, a cross-border character, at least between Mali and Mauritania, between Mauritania and the former Spanish Sahara, between Mali and Algeria, Niger and Algeria, Chad and Algeria, Niger and Chad, Chad and Sudan, between Sudan, Egypt, and Libya, between Algeria and Tunisia, and between Algeria and Libya (Lhote, 1946; Dupuy, 1967; Kowalski and RzebiK-Kowalska, 1991; Dragesco Joffé, 1993).



*Levé de soleil sur la région de Dakhla..Grand sud Marocain
© Didier Vangeluwe et Marie-Odile. Beudels IRScNB*

3. CONSERVATION STATUS, BY PARTY IUCN : RedList of Threatened Species 2004: CRA1cd

Morocco : extinct in the wild ; reintroduced in large fences within protected areas.

It is probably the populations linked to the large Mauritania-Malian ergs of the Majabat al Koubra and to the Iguidi and Chech ergs which occupied, with an unknown regularity, the Atlantic Sahara in the Dakhla region (Morales Agacino, 1950; Valverde, 1957; Loggers *et al.*, 1992) and gave rise to observations east of Zagora in the upper Drâa region of Morocco (Marçais, 1937; Loggers *et al.*, 1992). The few data from around Saquiat el Hamra suggest that they do not refer to permanent populations (Morales Agacino, 1950; Valverde, 1957; Loggers *et al.*, 1992). The last herd

was eliminated in 1942, and the last report dates from 1963, relating to an isolated female.

Tunisia: extinct in the wild ; reintroduced in large fences within protected areas.

The Addax was present in the Tunisian part of the Grand Erg Oriental, where the last animals were hunted around 1900, between Bir-Aouïn and the El Jenaïen Erg (Kacem, 1994). Kacem (1994) situates the date of extinction at around 1932. The species was successfully reintroduced in Tunisia in the Bou Hedma National Park in 1985 (Bousquet, 1992; Kacem, 1994). The translocation and reintroduction of the Addax in more Saharan environments, especially those of the Djebel National Park, is planned, and will be carried out once reinforcement of Saharan park protection is assured (2006).

Algeria: probably extinct.

Until the middle of the 19th century, the northern limit of the range of the Addax in Algeria reached the northern part of the Grand Erg Occidental (Colomb, 1856 and Mares, 1857 in Kowalski and Kowalska, 1991), and the southern part of Ouargla and Touggourt (Aucapitaine, 1860 in Kowalski and Kowalska, 1991). In the beginning of the 20th century, the northern limit of the range was much farther south, and at the same time, data appear on presence of the species in southern regions of Algeria which were until then inaccessible to prospectors. Grenot (1979) dates the extinction of the



*Parc National du Tassili N'Ajjer. Algérie. 2001.
© Marie-Odile Beudels-IRScNB*

species in the northwestern Sahara at around 1905 with the disappearance of the last herd in the Er Raoui Erg. The Addax probably disappeared from the Grand Erg Oriental in the beginning of the 20th century (Kowalski and Kowalska, 1991). Lhote (1946) reported presence of the species in 1938-1939 in the Hamada de Tinrhert; he observed the species in the Ténéré Erg at the Niger-Algeria border, and traces of Addax near the Malian border south of the Tanezrouft, to the north of the Adrar des Iforas. The species was still present in the north of the Iguidi Erg until the 1930's, but does not seem to have survived beyond that except on the Mauritanian side (Heim de Balsac, 1948). The presence of the Addax around the Hoggar massif, in the Tassili des Hoggar, in the Tassili des Ajjers, the Ténéré Erg, and the Hamada de Tinrhert was reported by several authors until the 1970's and even the 1980's (Lhote, 1946; Regnier, 1960; Dupuy, 1966, 1967b; De Smet, 1988). The Addax might currently still be a very occasional visitor, entering Algeria along the southern border with Mauritania, Mali, Niger, and perhaps even Libya.

Libya: probably extinct

In Libya, the scanty data suggest a former presence of the Addax on the piedmont slopes of the Haruj al Aswad, in the Koufra region and in the vicinity of the Calanshio dunes (Hufnagl, 1972). Hufnagl (1972) thought that it had become very rare, and even extremely rare in the Hamada el Homra, where the Tripoli museum specimens were taken in 1938. In the 1970's, Hufnagl records it again in the northeast and southeast, towards the Egyptian border (Kufra Oasis), as well as in the center of the Haruj el Aswad. Osborn and Krombein (1969) had reported, in the Jebel Uweinat region, the probable periodic presence of migrating Addax coming from the south, while Misonne considered it extinct in the area in 1977. Some individuals were pursued by hunters in 1975 in the Edyin de Murzuk (Gillet, 1971). Some individuals might still survive in 2005 in the Jabal al Awaynât, close to Egypt and Sudan (Essghaier, com. pers.)

Egypt : extinct

Kock (1970) and Osborn and Helmy (1980) summarized the observations of Addax in Egypt. Until the 1870's, they are numerous. They pertain to the Western Desert of Middle Egypt, where the Addax was known from the large oases and depressions or their peripheries, in particular from Siwa in the northwest, as well as from the Libyan oasis adjacent to Jaghbub, from the Qattara Depression, from Faiyum, from Bahariya, from Farafara, from Dakhla, and from the Kharga complex (Osborne and Helmi, 1980). The Addax was also observed in the extreme northeastern part of the Mediterranean coastal desert, in the Nubian Desert southwest of Bir Kiseiba, and in the region of Jebel Uweinat. This concentrated distribution is characteristic of most mammals in the Western Desert (Osborn and Helmi, 1980) and most likely reflects the reality of the distribution in this desert empty of vegetation (Osborn and Helmi, 1980). The last data refer to animals killed in 1900, 65 km west of Alexandria (Flower, 1932), and in 1931, in Scheb (Osborn and Helmi, 1980).

Mauritania: critically endangered

Eastern Mauritania is part of the range of Addax populations which were linked to the large Mauritania-Malian ergs of the Majabat al Koubra and to the Iguidi and Chech ergs (Monod, 1958; Gillet, 1969; Trotignon, 1975; Walter and Breckle, 1986; Lamarche, 1987). The southern limit of this part of the range descends to southeastern Mauritania between the 17th and 19th parallels. The Addax was still largely distributed in Mauritanian desert regions until the 1940's, but the Mauritanian range has greatly shrunk since (Sournia and Verschuren, 1990). The species probably survived until recently in several parts of the eastern deserts, especially the Dahr Tichit (Trotignon, 1975). Since 1980, the Addax has survived only in the Mreyyé area in the eastern part of the Majabat al Koubra (Lamarche, 1987); this range is occupied by the population also found in western Mali, which makes cross-border seasonal movements over distances of several hundred kilometres (Lamarche, 1987). This moving population was for a long period considered the biggest reservoir of Addax (Lamarche, 1987). It was already considered as threatened by the uncontrolled motorized hunting in the 80's and 90's (Sournia and Verschuren, 1990). There is no available data as to the presence of a residual population of Addax in this area.

Mali: critically endangered

Western Mali is also part of the range of Addax populations that were linked to the big Mauritania-Mali ergs of the Majabat al Koubra and to the Iguidi and Chech ergs (Monod, 1958; Gillet, 1969; Trotignon, 1975; Sayer, 1977; Walter and Breckle, 1986; Lamarche, 1987). The Addax is still present along the Mauritania-Malian border (Sayer, 1977; Lamarche, 1987); it is the same population also found in eastern Mauritania and that makes seasonal movements of many hundreds of kilometres, movements which, in the cold season, bring it to Mauritania in the region of the Mreyyé (Lamarche, 1987). The southern limit of this part of the range descends to the centre of Mali between the 17th and 19th parallels. This moving population was, for a long period, considered as the largest reservoir of Addax (Lamarche, 1987).

But it was already considered as threatened by uncontrolled motorized hunting in the 80's (Heringa, 1990; Sournia and Verschuren, 1990), and has not been observed for many years now (Niagaté, com. pers.). The Addax is not found in any protected area in Mali (Heringa, 1990). In the transition zone between the desert and the Sahelian steppes, regions of significant presence of Addax existed at least in the periphery of the Adrar des Iforas (Lhote, 1946). Lhote (1946) observed traces of the Addax near the Algerio-Malian border south of the Tanezrouft and to the north of the Adrar des Iforas ; nevertheless there is no data available since the end of the seventies for this area.

Niger: critically endangered

The Addax was formerly widely distributed in the desert zone of Niger, but it was eliminated from the largest part of its former range (Grettenberger and Newby, 1990). In the transition zone between the desert and the Sahelian steppes, large populations of Addax existed at least in the Ténéré, the piedmont slopes of the Aïr, and the Termit massif (Lhote, 1946; Brouin, 1950; Grettenberger and Newby, 1990; Millington *et al.*, 1991). It is currently still present in dune zones, in the east and northeast of the region of the Termit, the Ténéré desert, and in the northwest near the Algerian border (Grettenberger and Newby, 1990). The northern limit is situated around the 16th parallel. In 1990, Grettenberger and Newby estimated the population in Niger to be less than 200 individuals, of which about fifty were in the western part of the Ténéré desert inside the Aïr-Ténéré National Nature Reserve. Grettenberger and Newby (1990) also believed that the density of the Addax population around the Termit massif was probably greater than that of the Aïr-Ténéré Reserve.

This was largely confirmed during a recent survey : 128 Addax were observed (with 3 ULM on an area of 9300 km²) in september 2004 in the Termit (SOS Faune du Niger/DFPP/SZP mission). The termit-Tin Toumma population is now estimated at around 200 individuals (SCF/SSIG, 2005)



Addax skeleton. Niger. 2004
© John Newby

Chad : critically endangered

The Addax was formerly widely distributed in the sandy zones of the desert and semi-desert steppes north of the 15th parallel. It could even be locally abundant north of the Erguei and the Bodélé (Kanem), east of the Mourdi depression and farther east in the Ennedi, south of the Tibesti (Gillet, 1969; Newby, 1974), and in the Sudano-Chadian regions of the Mourdi and Wadi Howar (Sudan) depressions (Malbrant, 1952; Gillet, 1969; Kock, 1970; Wilson, 1980). Chad was, for several decades, the most important stronghold of the Addax, at a time when the species was disappearing under hunting pressure practically everywhere else (Thomassey and Newby, 1990). In the beginning of the 1970's, there were still undoubtedly several thousand Addax in Chad (Thomassey and Newby, 1990), but the situation has strongly degraded since, under the combined effects of hunting, years of drought, competition with domestic livestock, and military activities in the north of the country (Thomassey and Newby, 1990). In the 1970's, there were still a substantial number of Addax (around 800 individuals) in the north of the region of the Oued Achim-Oued Rimé, and these Addax moved northwards in the direction of the Tibesti during the rainy season (Thomassey and Newby, 1990). Military events occurring in 1978 compromised protection efforts achieved, and pushed the Addax farther and farther away towards even more marginal regions as far as the survival capacity for the Addax is concerned, than those areas where the species had been established (Newby, 1974). There are currently probably only a few individuals or a few very small groups left in the desert zones, remote and difficult to access, between the 15th and 17th parallels. Recent prospections, involving aerial censuses and ground observations, carried out by Pfeffer in 1990 and 1991, and renewed ground observations by Tubiana in 1995, indicated the presence of small groups of Addax on the Oued Achim, in the Mourdi depression, especially in its eastern part, on the Oued Chili, between Kalaït and Fada, and in the east of the Ennedi, between Bao Bilia and the Sudanese border (Pfeffer, 1995). Even more recent prospections have shown that the Addax is probably only present in very low densities, only two individuals were observed North of Egeui in september 2001 (Monfort *et al.*, 2003).

Sudan: probably extinct.

In the past, the Addax was widely distributed in the zones of desert and semi-desert steppes of northern Sudan, in the Nubian Desert of the North province and of northern Kordofan, in northern Darfur (Audas, 1951; Kock, 1970; Wilson, 1980; Hillman and Fryxell, 1988). It was widespread and even locally abundant until the 1930's-1940's (Brockelhurst,

1931; Shaw, 1936). By the end of the 1930's, the numbers had diminished considerably in the Kordofan (Audas, 1951) and elsewhere in the 1940's. From the 1950's onwards, information become rare (Wilson, 1980). No sign of presence of the Addax were recorded during aerial prospections conducted in the 1970's in northern Sudan (Lamprey, 1975; Wilson, 1980), but the species survived in small numbers in the Darfur until the end of the 1970's (Hashim, *in litt.* Nov. 1996).

4. ACTUAL *AND POTENTIAL THREATS

The decline of the species cannot be attributed to a single cause, but rather to an ensemble of factors which acted simultaneously and concurrently and were mutually reinforcing, that is, hunting associated with bad land management, drought and the desertification it entails, disturbance and insufficient protection (Newby, 1988).

4.1. Degradation and regression of habitats.

Recent periods of great drought, in the 1960's-1970's and the 1980's, induced a catastrophic expansion of desertification over the entire desert and sub-desert region of North Africa. Their effects on Addax populations were disastrous: reduction of winter pastures, increased scarcity of pasture lands in the dry season, loss of shade, and general disappearance of vital organic water resources (Newby, 1988). Previously, during comparable periods of drought, the Addax probably occupied more significantly the north-Sahelian zone of steppes (White, 1983, unit 54a). Sahelian steppes are subjected to a growing pressure for pastures by the livestock of nomad populations fleeing the drought. Livestock in the Sahelian zone is now in direct competition with the large natural fauna of the region. The Addax populations, in search for pastures, are forced to approach zones of human occupation, and have thus become more exposed to direct exploitation.

4.2. Direct exploitation.

Traditional methods of hunting, such as those practised until the 1960's (hunting with nets), and still, nowadays, hunting with spears and dogs, horses, and dromedaries, although resulting locally or periodically in large takes, could not have had a significant impact on Addax numbers (Brouin, 1950; Gillet, 1965, 1969; Newby and Grettenberger, 1986; Newby, 1988; Dragesco-Joffé, 1993). For the last 30 or 40 years, excessive hunting with modern arms has reduced the populations to such a degree that traditional hunting can practically no longer be done (Newby and Grettenberger, 1986). Man is clearly the main instrument of the decline of the species, mainly since the end of the 1940's, with the advent of the deadly combination of firearms and off-road vehicles, as documented by Gillet (1965, 1969), Newby (1986, 1988) and Dragesco-Joffé (1993), who show that hunting, carried out in an irresponsible way by mining, military, and administrative personnel, is the principal cause of the staggering decline of the Addax. These (illegal) taking still today, e.g. in the Termit 11 to 14 Addax were reported to have been killed in august 2002, and 3 to 5 in 2003 (SOS Faune du Niger; Greth *et al.*, 2003).

4.3. Other threats.

Tourism is and has been an additional threat to the Addax, particularly in Niger where Newby (1989, 1990) notes tourists chasing Addax with off-road vehicles. Chased and harrassed in this manner, the Addax starts galloping and can die within ten minutes.

Addax horns in a poacher's camp, found by SOS Faune du Niger: Termit, Niger. © Tim Wacher-ZSL Niger 2004. Garbage left by illegal hunters. © John Newby. Mission SSIG-SCF 2004



All of the indirect human pressures likely to affect the species, such as the increase of wells, the extension of domestic livestock, and the invasion of available habitats, have an effect through the degradation or the regression of habitats and the rise in vulnerability to taking and harassment. These have been treated in the preceding paragraphs.

5. REGULATORY PROVISIONS

5.1. International.

Bonn Convention: Appendix I, Resolution 3. 2, paragraph 4.

Washington Convention (CITES): Appendix I



Addax. & Oryx. Bou-Hedma NP. Morocco. 2002
© R.C. Beudels-IRScNB.



Addax. Souss-Massa NP. Morocco. 2005
© Heiner Engel. Hannover Zoo.

5.2. National.

6. CONSERVATION MEASURES, PER PARTY

6.1. Ban on taking.

6.2. Habitat conservation.

Morocco :

The proposed parks of the Drâa basin and of Dakhla-Adrar Souttouf (Müller, 1966) seem suitable for reintroducing the species. The few existing data for these zones suggest that they did not support permanent populations of Addax. The current practical impossibility of ensuring security of movement towards other regions will perhaps necessitate active management of the habitat.

Tunisia:

The Addax has been extinct in Tunisia since the 1930's. In 1980, the Tunisian Government established the Bou Hedma National Park, 16,488 hectares of steppes and *Acacia raddiana* woodlands, of which 4500 hectares are managed under a system of total protection. The Bou Hedma Park, in which a programme of habitat restoration has been successfully conducted (Bertram, 1988; Bousquet, 1992; Kacem, 1994), represents an optimal site for reintroduction of *Oryx dammah*. It represents for the Addax more a reproduction centre for its restoration in to more suitable areas in Saharan parks such as Djebil National Park, once planned reinforcement of these parks is assured. Management of the habitat at Djebil may have to be considered. Translocation of the Bou-Hedma Addax into Djebil NP is planned by the Tunisian authorities in 2006.

Algeria:

The Tassili des Ajjers National Park and the proposed Hoggar National Park offer, because of their exceptional size and environmental diversity (Bousquet, 1992), possibilities for reintroduction. The rarity of observations in these regions for the last few decades does not allow exclusion of the need for habitat management.

Mali:

A small population could still survive in western Mali, at the Mauritania-Malin border, threatened by uncontrolled motorized hunting (Heringa, 1990; Sournia and Verschuren, 1990). At present the Addax is not present in any protected area in Mali (Heringa, 1990). Prospections will have to be conducted when the situation permits.



Mauritania:

Since the 80's, the Addax has survived in Mauritania only in the Mreyyé region in the eastern part of the Majabat al Koubra (Lamarche, 1987); this population is the same as the one found in western Mali, which performs seasonal cross-border migrations of several hundred kilometres between Mali and Mauritania (Lamarche, 1987). This population could still be a reservoir of Addax today (Lamarche, 1987). Hunting practices in Mauritania expose this population to considerable risks (Lamarche, 1987; Sournia and Verschuren, 1990). Strict protection measures must be taken to prevent irresponsible motorized hunting in the Mreyyé (Lamarche, 1987). The Addax is at present not found in any protected area in Mauritania. Firm protection efforts towards this population of Addax are essential to the survival of the species. Special efforts must imperatively be made to control hunting and poaching.



Addax. Temet. Niger. © John Newby

Niger:



*Wadi Rimé-Wadi Achim Reserve in the 70'.
Projet WWF-UNEP. © John Newby.*

Within the perimeter of the Aïr-Ténéré National Reserve (RNNAT), a sanctuary was created in 1988 specifically for the preservation of the Addax. Unfortunately, the Addax was eliminated from the RNNAT through poaching. A proposed protected area (2006 ?) in the region of the Termit-Tin Toumma, where the last viable population of Addax in the world still occurs, might represent the last chance of survival of the species *in situ*. Reintroduction in the RNNAT might be considered in the future in the light of the current environmental and social context, after new evaluations of the chances of survival of the species in the wild.

Chad:

The Ouadi Rimé-Ouadi Achim Reserve is an essential site for Addax and Oryx restoration in the future (Grettenberger and Newby, 1990; Pfeffer, 1993a, 1995). Addax have still been sighted recently in the north of the Reserve. Rehabilitation of the Reserve, badly treated since the military conflicts and decimated by poachers, is a prerequisite for any action (Grettenberger and Newby, 1990). The implementation of strict protection measures for the habitat and the fauna is crucial.

Sudan:

A proposal to establish a protected area in Wadi Howar in Northern Darfour, would provide an opportunity to restore populations of Addax if it became necessary and feasible. Considering the degraded conditions of the steppe areas in Sudan, substantial habitat restoration measures may be a necessary prerequisite. To control poaching within large protected areas may be extremely difficult (Cloudsley-Thompson, 1992).

6.3. Attenuation of obstacles for migratory animals.

Given the present state of the populations, the question is without object. In the event of restoration, or as reintroduction projects progress, it could become a new concern. In the short and medium term, only the creation of protected areas large enough to include the entire range, including migratory movements necessary during periods of drought, and, in particular, cross-border reserves, seems to be an adequate answer. It seems indeed unlikely that security of movement between protected areas can be realistically assured in the foreseeable future.



Addax. Termit. Niger. 2004. Mission SOS Faune du Niger © Hubert Planton-SZP/IRD



6.4. Regulations concerning other detrimental factors.

6.5. Other measures.

Outside range:

The species is raised in captivity or semi-captivity in various countries in North Africa, the Middle East, Europe, and North America.



Talking with nomads. Niger. Mission SSIG-SCF. 2004. © Tim Wacher-ZSL

7. RESEARCH ACTIVITIES

7.1. Public authorities.

New prospection efforts are needed to evaluate the residual populations of Addax, essentially in Niger and Chad (Newby, 1989).

Research and experiments must be conducted in the domain of rational use of the Addax as an exceptional resource capable of utilizing extreme environments.



Addax habitat. Tin-Toumma. Niger. 2004 © John Newby

7.2. N.G.O.s

8. NEEDS AND RECOMMENDED MEASURES

Recommended measures are detailed in ASS-CMS Action Plans (Beudels *et al.*, 1998). The principal needs that they meet are listed below.

However, the survival of the Addax, and the future of the Saharan biodiversity, will depend mostly on right political decisions taken at the highest levels, in key Range States such as Niger and Chad. A moratorium on hunting, for example, would be particularly useful until efficient protected areas can be implemented, with proper buffer zones established between protected areas and hunting concessions.

8.1. Total protection of the species.

Required in all the countries of the historical range in order to prepare a possible redeployment of the species.

8.2. Conservation measures.

Establishment of networks of protected areas in all parts of the historical range of the Addax, based on the guidelines stated in point 2.2.4., with absolute priority given to zones where the species could be surviving in the wild, most importantly, to the protection of the Termit-Tin Toumma massif in Niger; the prospection and preservation of large areas within the Majabat-al-Koubra in Mauritania and Mali, the rehabilitation of the Ouadi Rimé-Ouadi Achim Reserve in Chad, and to the reinforcement of the Aïr-Ténéré Reserve in Niger, require also urgent attention.

8.3. Location and monitoring of residual populations, and clarification of their ecological requirements:

Niger: Further inspections to evaluate exact range of the Addax population around the Termit massif.

Chad: Urgent need for new inspections to evaluate residual populations of Addax.



8.4. Reinforcement of populations and reintroduction into the potential range.

Support for the Tunisian reintroduction programme.

Support for the Moroccan reintroduction programme.

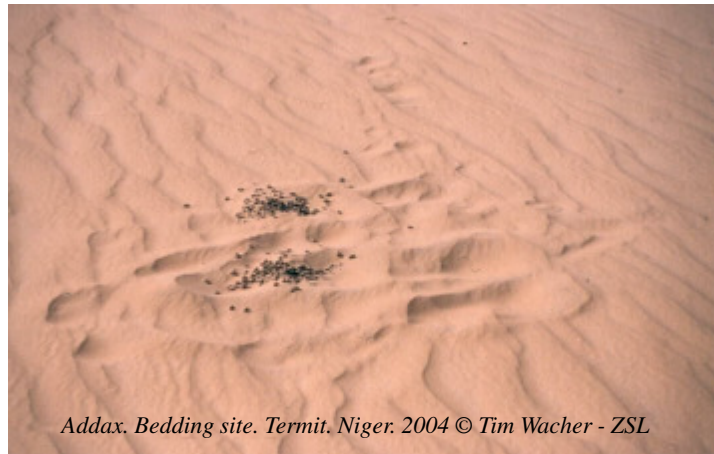
Preparation of programmes in other regions of the historical range, according to the guidelines stated in point 2.2.4.

New evaluation of the possibilities of reinforcing the populations in Niger and Chad.

Study the possibilities of reviving the project to establish a captive breeding centre at the former ranch of Gadabedji, as proposed in the 80's (Oryx, Dama gazelles and Addax).

9. CONSERVATION AND RATIONAL USE

In the recent past, large mammals were important as a source of protein and for their exchange value in all the desert and semi-desert zones of North Africa, and represented an important resource in particular for the people of the desert. For the last sixty years, these large mammals have gradually disappeared, but the number of livestock, in Niger for example, has increased significantly in certain periods (Newby and Grettenberger, 1986). During periods of drought, this livestock diminished considerably. If large mammals could be reintroduced or their numbers increased until they reach sufficient levels, and if they could be managed as a natural resource, these species, adapted to survival in extreme conditions, could become highly valuable for sustainable development of these regions. Research and experimentation should be undertaken in this sense.





Small valley with Leptadenia . South-Tamesna. 2005. © François Lamarque

Gazella dama



René-Marie Lafontaine, Roseline C. Beudels-Jamar, Pierre Devillers.
Institut royal des Sciences naturelles de Belgique



Stone carving of a Gazella dama. Rupestrian art. Air. Niger. © Nils Robin

Drawing : Gazella dama. J.Smit in Sclater & Thomas, 1899



Gazella dama

1. TAXONOMY AND NOMENCLATURE



Gazella dama. Bou-Hedma National Parc. Tunisia.
© Heiner Engel. Hannover Zoo. 2005.

1988; Alados *et al.*, 1988; Dragesco-Joffé, 1993; Cano *et al.*, 1993; Kacem *et al.*, 1994; Abaigar *et al.*, 1997). The geographical variation appears clinal, with regions of steepening of the gradient (Groves, 1988); geographical variation is somewhat obscured by individual variation (Brouin, 1950; Malbrant, 1952; Dragesco-Joffé, 1993). Usually three sub-species are distinguished: *Gazella dama mohrr* in the Atlantic Sahara, *Gazella dama dama* in the western and central Sahel, and *Gazella dama ruficollis* in the eastern Sahel (Cano, 1984; Cano *et al.*, 1993; Kacem *et al.*, 1994; Abaigar *et al.*, 1997). Uncertainty exists about the identity of the extinct Sahelian populations of Senegal, included in *Gazella dama dama* after the work of Sclater and Thomas (1898), and again recently by Kacem *et al.* (1994), in *Gazella dama mohrr* by Cano (1984), Cano *et al.* (1993), and Abaigar *et al.* (1997). This uncertainty contributes to doubts about possible geographical isolation of the Atlantic form *Gazella dama mohrr*, morphologically the most distinct. Kacem *et al.* (1994) suppose a hiatus in distribution between *Gazella dama mohrr* and *Gazella dama dama* in the south of Mauritania. This is not apparent on the map of distribution drawn by Trotignon (1975), but is confirmed, however, by an examination of the historical data he collected. In any event, possible future efforts to reintroduce, and even more to reinforce, populations must respect the geographical variation of the species as far as possible, even if its clinal character does not require differential treatment of sub-species. The only probable exception is that of *Gazella dama mohrr* whose geographical isolation and coastal desert specialisation are probable.

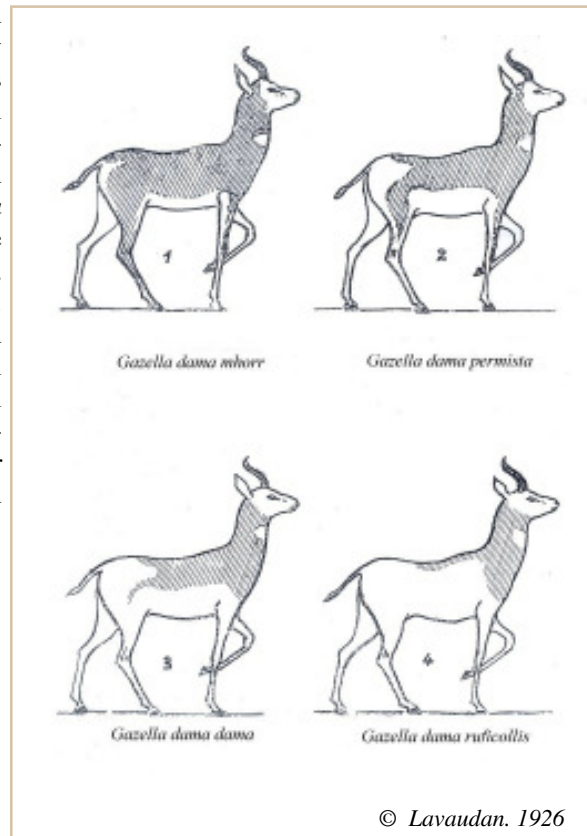
1.2. Nomenclature.

1.2.1. Scientific name.

Gazella dama (Pallas, 1766).

1.1. Taxonomy.

Gazella dama belongs to the tribe Antilopini, sub-family Antilopinae, family Bovidae, which comprises about twenty species in genera *Gazella*, *Antilope*, *Procapra*, *Antidorcas*, *Litocranius*, *Ammodorcas* (O'Regan, 1984; Corbet and Hill, 1986; Groves, 1988). Genus *Gazella* comprises one extinct species and from 10 to 15 surviving species, usually allocated to three sub-genera, *Nanger*, *Gazella* and *Trachelocele* (O'Regan, 1984; Corbet and Hill, 1986; Groves, 1988). *Gazella dama* is one of three species forming the group of giant gazelles (Groves, 1988) of sub-genus *Nanger* (O'Regan, 1984). The other two species, *Gazella soemmerringi* and *Gazella granti*, are linked to the semi-deserts, dry thickets, dry woodlands, steppes, and open savannas of northeastern and eastern Sudanian Africa. *Gazella dama* is polytypic, comprising three to nine recognised sub-species (Cano, 1984; Groves,



© Lavaudan. 1926



1.2.2. Synonyms.

Antilope dama, *Cerophorus dama*, *Cemas dama*, *Antilope nanguer*, *Gazella nanguer*, *Antilope mhorr*, *Nanger mhorr*, *Gazella mhorr*, *Gazella mohr*, *Antilope mhoks*, *Antilope dama*, var. *occidentalis*, *Antilope ruficollis*, *Gazella ruficollis*, *Antilope addra*, *Antilope dama*, var. *orientalis*

1.2.3. Common names.

English:	Dama Gazelle, Addra Gazelle
French:	Gazelle dama, Biche-Robert, Mohrr, Gazelle mhorr, Mohor, Gazelle mohor, Nanguer (Buffon), Ména, Grande gazelle
German:	Damagazelle
Tamachek:	Tenhert
Arabic:	Ariel, Ril
Tamashek:	Enir

1.2.4. Description

The coloration of the coat is quite variable, and is used to distinguish subspecies. The face and underparts are white in all described forms. The coat is bright white, with reddish brown or chestnut on the neck. However, as one travels from east to west through this species' range, the extent of coloration increases dramatically, with the western-most subspecies being almost completely red except for the undersides and rump. All races have a small white patch on the throat. The face has relatively few markings, being completely white in eastern subspecies, but with red cheek patches and thin black stripes running from the eyes to the corners of the mouth in the western subspecies - the Mhorr gazelle. The body is supported by thin legs, and the neck is long and slender. The horns are found in both sexes, though generally larger and thicker in males. They are "S" shaped, slanting backwards, then curling upwards. The tail is short and white, with a sparse fringe (Mallon & Kingswood 2001).

TL:	95 - 165 cm
T:	26 - 35 cm
H:	90 - 120 cm
Weight:	(male) 40-75 kg (female) 35-40 kg
Horns :	25-35 cm

2. BIOLOGY OF THE SPECIES

2.1. General Biology

2.1.1. Habitat.

Characteristically, the Dama Gazelle has a mixed diet of grazing gramineous or non-graminid herbaceous plants, and of browsing the foliage of ligneous species, which play a particularly important role in its ecological requirements (Newby, 1974). In the Sahelian region the trees and shrubs that are preferentially browsed comprise *Acacia senegal*, *Acacia raddiana*, *Acacia erhenbergiana*, *Maerua crassifolia*, *Capparis decidua*, *Capparis corymbosa*, *Cadaba farinosa*, *Boscia senegalensis*, *Guiera senegalensis*, *Grewia villosa*, *Grewia tenax*, *Balanites aegyptiaca*, *Chrozophora senegalensis*, *Leptadenia pyrotechnica*, and *Commiphora quadricenta*. The forbs, frutescents, and grasses grazed include *Limeum viscosum*, *Monsonia senegalensis*, *Boerhavia repens*, *Cucumis melo*, *Tephrosia lupinifolia*, *Tephrosia obcordata*, *Indigofera aspera*, *Tribulus terrester*, *Tribulus ochroleucus*, *Borreria radiata*, *Blepharis linariifolia*, *Commelina forskalai*, *Eleusine flagellifera*, *Cyperus gemenicus*, *Aristida mutabilis*, *Aristida pallida*, *Schmidtia pappophoroides*, and *Panicum turgidum*, (Brouin, 1950; Malbrant, 1952; Newby, 1974; Grettenberger and Newby, 1986; Dragesco-Joffé, 1993). The gazelle also consumes the pods and flowers of *Acacia spp.* (Dragesco-Joffé, 1993). Its water needs are met in part, as for many other Sahelo-Saharan species, by the wild melon, *Colocynthis vulgaris* (*Citrullus colocynthis*) (Newby, 1974; Dragesco-Joffé, 1993).





Faeces and habitatt. Manga. Chad. © Tim Wacher- ZSL



Northern Termit. Niger. © SSIG-SCF

Tracks of *Gazella dama*



Sud-Tamesna. Mali. 2005 © Stéphane Bouju

The presence and density of trees appear to condition the distribution of the Dama Gazelle (Grettenberger and Newby, 1986). Its close connection with acacia woodlands and their accompanying flora has been noted by numerous observers in various parts of the range (Sclater and Thomas, 1898; Lhote, 1946; Brouin, 1950; Morales Agacino, 1950; Malbrant, 1952; Valverde, 1957; Kowalski and Rzebik-Kowalska, 1991; Dragesco-Joffé, 1993; Kacem *et al.*, 1994). In Niger, Grettenberger and Newby (1986) documented its strong preference for the major wadis and their flood plain, secondarily for the steppes of zones of water movement and the dunes invading the wadi beds, environments in which trees remain in better condition during the dry season and bring shade and fodder in the hot season. In the same way, in the Atlantic Sahara, *Gazella dama mohrr* mainly occupied wadis dotted with acacia woods of variable density (Morales Agacino, 1950; Valverde, 1957). There they ate the leaves of *Acacia seyal* with a complement of leaves from *Maerua*, *Calotropis*, *Balanites*, *Salvadora*, *Leptadenia*, and *Ziziphus*.

However, in the Northwestern part of its range, in areas lying some 10-50 km from the Atlantic Ocean, *Gazella Dama* were found in dense wooded steppes without acacia (Cuzin 2003). In the Saharian Northwest, *Gazella Dama* probably fed mostly on *Argania spinosa* foliage, in the same way as *Gazella dorcas* et *Gazella cuvieri* (Cuzin 1998). Nowadays, mostly because of poaching pressure, *Gazella Dama*'s distribution appears limited to areas where vehicule access is practically impossible : the inaccessibility of sites conditions probably now its repartition (Lamarque, com. pers., 2005).

2.1.2. Adaptations.

The Dama Gazelle is a desert/semi-desert species and is drought resistant. Most of its water is obtained from its plant food. It is both a browser and a grazer. The Dama Gazelle browses on various desert shrubs and acacias. In times of drought it also eats rough desert grasses.

Dama Gazelles occupied the same ecological zones as the Scimitar-horned Oryx, and both species ecology were very similar. Like most desert species, the Dama Gazelle is highly nomadic, ranging widely in order to obtain sufficient nutrition. In addition, these gazelles undertake large seasonal migrations, moving north into the Sahara desert during the rainy season, and retreating south into the Sahel during the dry season. To maximize the amount of food available, these gazelles may stand on their hind legs in order to reach leaves above the normal browsing height.

2.1.3. Social behaviuor

The social organization of Dama Gazelles is greatly affected by the seasons. Herds typically spend the dry season in the Sahel where they occur singly or in mixed groups of 10 - 15, composed of a dominant adult male, several adult females, and young. With the onset of the rainy season, they migrate into the desert, where, in the past, aggregations including males and females could include several hundred individuals. (Mallon & Kingswood 2001, AZA Antelope TAG). Male Dama Gazelles become territorial during the mating season

2.2. Distribution.

2.2.1. Historical distribution.

The range of the Dama Gazelle resembles that of the Scimitar-horned Oryx (*Oryx dammah*), with which it largely shares ecological requirements, with however a slightly greater tolerance for desert zones (Dupuy, 1967) and rocky environments. The zone of historical distribution consequently comprises more or less the same Sahelian and Atlantic sections, but extends to the central Saharan massifs. On the other hand, it seems never to have included a Mediterraneo-Saharan sector (Sclater and Thomas, 1898; Lavauden, 1920; Heim de Balsac, 1931; Dupuy, 1967; Kowalski and Rzebik-Kowalska, 1991; Loggers *et al.*, 1992), nor any extension into the oases of the Libyan Desert of middle Egypt (Osborn and Helmy, 1980); the observation of *Antilope dama* by Schweinfurth in Dakhla clearly refers to the oryx, not to the gazelle (Osborn and Helmy, 1980).

The main, Sahelian, range of *Gazella dama* coincides, like that of *Oryx dammah*, with the semi-desert Sahelian steppes belt of White (1983), forming his unit 54a in region XVI, largely corresponding to that of the sub-Saharan *Aristida* steppes of Rattray (1960), comprising his units A11, A13, A15, the sub-desert steppes of Newby (1974), and the Saharan savannas of Schulz (1988) and Ozenda (1991). These steppes extend across the centre-south of Mauritania between 18° (locally 20°) and 16° N, the centre of Mali between 18° and 15°N, of Niger between 17° and 15°N, of Chad between 17° and 14°N, and of Sudan between 17° and 12° 30'N (Lhote, 1946; Malbrant and Maclatchy, 1949; Brouin, 1950; Audas, 1951; Malbrant, 1952; Dekeyser, 1955; Cornet d'Elzius and Gillet, 1964; Newby, 1974; Lamprey, 1975; Schnell, 1976; Wilson, 1978, 1980; Monod, 1986; Grettenberger and Newby, 1986, 1990; Hillman and Fryxell, 1988; Sournia and Verschuren, 1990; Heringa, 1990; Thomassey and Newby, 1990; Millington *et al.*, 1991; Dragesco-Joffé, 1993; Kacem *et al.*, 1994; Hashim, 1996). Towards the south, the distribution of the Dama Gazelle advanced widely in the southern Sahelian band



of deciduous shrubs or thickets (White, 1983, region XVI, unit 43) in Senegal (Sournia and Dupuy, 1990), in Burkina Faso (Heringa *et al.*, 1990), in Mauritania (Trotignon, 1975), in Mali (Lhote, 1946), in Niger (Lhote, 1946), in Chad (Malbrant, 1952; Newby, 1974), in Sudan (Audas, 1951), and in Nigeria (Anadu and Green, 1990). The Sahelian range included the southern Saharan massifs of the Adrar des Iforas in Mali, the Air in Niger, the Ennedi in Chad, and the Darfur in Sudan (Lhote, 1946; Brouin, 1950; Chopard and Villiers, 1950; Malbrant, 1952; Newby, 1974; Lamprey, 1975; Wilson, 1980; Monod, 1986; Grettenberger and Newby, 1986; Kacem *et al.*, 1994).

Contrary to the Oryx, the Dama Gazelle was able to survive until the recent past in the insular central Saharan massifs (Heim de Balsac and Mayaud, 1962; Simon, 1965; Ozenda, 1991) which harbour, at the favour of humidity gradients, in particular in the valleys, *Aristida* sub-desert steppes, as defined by Rattray (1960), and multiple ligneous formations (Schnell, 1977; Ozenda, 1991), and locally reproduce conditions somewhat similar to those of the Sahelian sub-desert fringe. Its presence is well documented in the vast mountainous group formed by the Hoggar and the Tassili des Ajjers in Algeria (Regnier, 1960; Dupuy, 1967; De Smet, 1989; Kowalski and RzebiK-Kowalska, 1991), mainly in the southern part of the complex (Dupuy, 1967). It was noted several times in the western piedmont of the Tibesti, but was perhaps rarer there than in the Algerian massifs (Dalloni, 1936; Malbrant, 1952).

The range of *Gazella dama mohrr* coincides more or less with the oceanic and sub-oceanic Atlantic Sahara, a cold-current coastal and attenuated desert comprising a sublittoral zone, 200 to 300 kilometres wide, where steppes and acacia woodlands abound, allowing the Sahelian flora and fauna to penetrate far north (Valverde, 1957; Monod, 1958; Rattray, 1960; Quézel, 1965; Schnell, 1977; White, 1983; Edmondson *et al.*, 1988; Dakki and Parker, 1988; Ozenda, 1991). Numerous observations of the Dama Gazelle have been made in this very peculiar desert (Sclater and Thomas, 1898; Morales Agacino, 1950; Valverde, 1957; Trotignon, 1975; Loggers *et al.*, 1992), in a belt which extends from the Oued Noun, in Morocco, to the north, to the Inchiri, in Mauritania, to the south, and almost never exceeds a width of 200 to 300 kilometres. Even though the map of distribution proposed by Trotignon (1975) for the species in Mauritania indicates a continuity between this Atlantic population and the Sahelian populations of southeastern Mauritania, this is not supported by the historical observations he compiled and a cartographic examination indicates, on the contrary, a large gap between the two ranges.

2.2.2. Decline of the range.

In the 1940's the Dama Gazelle still seemed very common in the Sahelian part of its range, but already very rarefied in the Atlantic Sahara and in the central Saharan massifs (Lhote, 1946; Brouin, 1950; Dupuy, 1967). Yet at the end of the 1950's, Valverde (1957) noted a sharp increase in the Spanish Sahara, after near extinction, because of effective protection against poaching. He observed a density close to 150 animals per 100 kilometres of road. However, shortly afterwards, the species practically disappeared from the region, Loggers *et al.* (1992) only collecting one observation for the period 1960-1970, and one other for the period after 1980. *Gazella dama mohrr* is quite certainly extinct in the wild. In the complex of the Hoggar and the Tassili des Ajjers, the last data gathered by Kowalski and RzebiK-Kowalska (1991) date from the 1960's and the species is also generally considered extinct (Dragesco-Joffé, 1993).



Poached Dama. Niger. 2004. © John Newby

With regard to the Sahelian populations, a significant regression was observed in the 1960's and 1970's with probable extinction in Mauritania (Trotignon, 1975; Verschuren, 1984) and in Senegal (Sournia and Dupuy, 1990). In the early 1980's, relatively large populations were surviving in Mali, Niger, and Chad, and perhaps very small numbers in Sudan (Newby, 1982). In the beginning of the 1990's they had been reduced to dispersed, relict and declining populations, in Mali (Heringa, 1990) and in neighboring Burkina Faso (Heringa *et al.*, 1990), in Niger (Grettenberger and Newby, 1990; Dragesco-Joffé, 1993), and in Chad (Thomassey and Newby, 1990).

2.2.3. Residual distribution.

Populations of the Dama Gazelle survive in the Sahel, at least in Mali, Niger, and Chad, and perhaps also in Burkina Faso and Sudan, its survival in eastern Mauritania seems very improbable (F. Lamarque, com. pers.). In Mali they are probably several hundred strong and slightly increasing (Duvall *et al.*, 1997). In Niger, where the zone of the Air-Ténéré and the Termit constitutes one of the last bastions of the species, Dragesco-Joffé (1993) evaluated the population at 400 animals. In Chad the species is currently very rare in the Ouadi Rimé-Ouadi Achim Reserve (Moksia and Reouyo, 1996).

It is possible that *Gazella dama mohrr* still survives in a few isolated pockets in parts of its historical area of distribution. Cuzin (1996) notes observations made by nomads in the Drâa basin in 1993. In Adrar Souttouf, the last observation was made in 1973 (F. Cuzin, comm. pers.), and south of the Draa, the last observation was made in 1980, south-west of Assa (Cuzin 1998).

2.2.4. Recolonisation prospects.

The survival of several Sahelian cores makes recolonisation of the entire Sahelian range possible, insofar as an adequate network of protected areas can be established. To be usable by the species, these areas must benefit from a sufficient degree of protection against taking, but also be the subject of environmental rehabilitation, particularly of the woodlands of acacia and other ligneous species on which the Dama Gazelle seems to depend. The central Saharan massifs could eventually be reoccupied from Sahelian sources if these core populations were able to rebuild and regain sufficient vigour. The Hoggar and the Tassili des Ajjers populations were certainly in communication with those of the Adrar des Iforas and the Aïr (Lhote, 1946; Dupuy, 1957). However, it is probable, given the inevitable ecological insularisation of protected areas, whether they be Sahelian or Saharan, that the zones where favourable conditions are recreated, but where the species is no longer present, will repopulate naturally only with great difficulty.

With regard to *Gazella dama mohrr*, extinct or on the edge of extinction in the wild, the best possibility of redeployment appears, as for the Oryx, to be in the region of Dakhla-Adrar Souttouf. More to the south, the species was still recently observed in the continental part of the Banc d'Arguin National Park or on its confines. The recent presence of the species at the northern limits of its historical range, in the Drâa basin, offers another possibility.

A number of protected areas, existing or potential, in which restoration of the Dama Gazelle populations could be envisaged, by means of protection, management, and, if necessary, restoration of the habitat, or, in case of current absence, reintroduction of the species, are listed in Table 1. Their choice takes into account the possibility of simultaneous use for *Oryx dammah*.

Table 1. Zones of particular interest for the restoration of *Gazella dama* populations.

Segment of the potential range	Country	Site
North of the Sahelian range	Chad	Ouadi Rimé-Ouadi Achim
	Niger	Termit
	Niger	Aïr-Ténéré
	Mali	North Tamesna
	Sudan	Wadi Howar-Darfur
	Mauritania	Southeast
South of the Sahelian range	Senegal	Ferlo
	Mali	Gourma, Ansongo-Menaka, South Tamesna
	Niger	Gadabedji
	Burkina Faso	Seno-Mango
Atlantic Saharan range (<i>Gazella dama mohrr</i>)	Morocco (ex-Spanish Sahara)	Dakhla
	Morocco	Drâa
	Mauritania	Banc d'Arguin
Central Saharan massifs	Algeria	Hoggar, Tassili des Ajjers

2.3. Evaluation and evolution of populations.

The populations have experienced a catastrophic decline accompanied by extinction of local populations, perhaps including the extinction of an isolated form, *Gazella dama mohrr* (including *Gazella dama lazanoi*). The most recent population estimates, pertaining to the end of the 1980's and the beginning of the 1990's, is of less than 1500 individuals for the entire range, of which 400 in Niger (Dragesco-Joffé, 1993). The fragmentary indications available for later years suggest even lower figures (Pfeffer, 1993a, 1993b, 1995; Beudels *et al.*, 1994; Moksia and Reouyo, 1996).

2.4. Migration.

The Dama Gazelle undertakes movements of medium amplitude according to the availability of pastures. The cycle of these migrations, during which it could form herds of 100 or 200 head, sometimes up to 600 (Brouin, 1950), is, in the Sahel,



similar to that of the Scimitar-horned Oryx (Brouin, 1950; Malbrant, 1952; Newby, 1974; Dragesco-Joffé, 1993). Its stay in the south of the range seems, however, longer than that of the latter species (Newby, 1974). In Chad, Newby (1974) observed a retreat towards the south as of January and February, an increasing concentration in the large wadis during the hot season, from March to May, a new progression towards the south, as for the Oryx, at the time of the first rains, at the end of May or the beginning of June, and migration towards the north in June and July.

The cyclic, seasonal, or interannual migrations of the Dama Gazelle have or had a cross-border character between Mauritania, the former Spanish Morocco, and Algeria (Valverde, 1957; Trotignon, 1975; Kowalski and Rzebik-Kowalska, 1991), between Mauritania and Mali (Trotignon, 1975), between Mali and Niger (Lhote, 1946), between Mali and Algeria (Lhote, 1946; Dupuy, 1967; Kowalski and Rzebik-Kowalska, 1991), between Niger and Algeria (Lhote, 1946), between Mali and Burkina Faso (Heringa, 1990; Heringa *et al.*, 1990), between Niger and Chad (Dragesco-Joffé, 1993), and between Chad and Sudan (Wilson, 1980).

3. Conservation status, by party

IUCN : RedList of Threatened Species 2004 : EN A1c, C1

Morocco : extinct or on the edge of extinction

The largest part of the historical range of *Gazella dama mohrr* consists of an oceanic and sub-oceanic desert band about 200 kilometres wide, extending from the Oued Noun to the southern border of the former Spanish Sahara (Sclater and Thomas, 1898; Morales Agacino, 1950; Valverde, 1957; Trotignon, 1975; Loggers *et al.*, 1992). Observations exist outside of the Atlantic Sahara proper, in the Mediterraneo-Saharan zone immediately to the north of it, and in the adjacent Sahara in the Drâa basin, northwest to the region of Zagora (Loggers *et al.*, 1992). The species was already extremely rare in the 1940's (Valverde, 1957; Dupuy, 1967), then re-established itself locally in the 1950's (Valverde, 1957), before collapsing. Only one observation exists for the period 1960-1970, and one other for the period after 1980, both in the Drâa basin (Loggers *et al.*, 1992), so that the extinction of the Moroccan population and consequently that of *Gazella dama mohrr* are to be feared. It is possible, however, that the Mohr survives in very small numbers in the Drâa basin and in the Adrar Souttouf (Cuzin, 1996).

Algeria: extinct or on the edge of extinction

Gazella dama mohrr frequented, perhaps irregularly, the Tindouf hamada and the Drâa hamada in the extreme west of the country (Dupuy, 1967; De Smet, 1989; Kowalski and Rzebik-Kowalska, 1991). The last observations date back to the 1940's and 1950's. In addition, an area of regular presence of *Gazella dama dama* existed in the Hoggar massif and its surroundings (Dupuy, 1967; De Smet, 1989; Kowalski and Rzebik-Kowalska, 1991). This population was probably in contact with that of the Adrar des Iforas in Mali and perhaps with that of the Aïr in Niger (Lhote, 1946; Dupuy, 1967). The last data recorded by Kowalski and Rzebik-Kowalska (1991) for the complex of the Hoggar and the Tassili des Ajjers date back to the 1960's and the species has generally been considered extinct there (De Smet, 1989; Kowalski and Rzebik-Kowalska, 1991; Dragesco-Joffé, 1993), but Bousquet (1992) and De Smet and Mallon (1997) suggest possible survival.

Libya: probably extinct

The Dama Gazelle was present in the first half of the 20th century in the periphery of the Tibesti in Chad (Dalloni, 1936; Malbrant, 1952), and Hufnagl (1972) suggests that it reached the south of Libya. A relict population could still survive in the Tibesti region near the Chadian border (Essghaier, com. pers., 2005).

Mauritania: probably extinct

Northwestern Mauritania is part of the Atlantic Saharan range of *Gazella dama mohrr*, while the southeast is part of the Sahelian range of *Gazella dama dama*. These ranges were perhaps in contact but the data gathered by Trotignon (1975) indicate a gap. In the Atlantic zone, the data are limited to the immediate surroundings of the eastern border of the former Spanish Sahara, especially in the region of Bir Moghreim (Fort Trinquet) at 25° 30' N, and to a coastal band about 200 kilometres wide extending from the southern border of the former Spanish Sahara to the Inchiri in the south. The gazelle was noted particularly in the Taziezet, the region of Chami, the Tijirit, and the Inchiri. The last observations there date back to 1967-1968 (Trotignon, 1975). In the eastern Sahelian range, the species was distributed in the 1930's to the 1960's as far as the Adafer, the region of Tidjika, the Tagant, the Aoukar, and the region of Kiffa. It was more common in the

southeast, in the Semi-Aklé, the region of Oualata, the Achemine, the Irrigi, the region of Néma, and the region of Bassikounou (Trotignon, 1975). The last observations cited by Trotignon (1975) are in the extreme east and date from the middle of the 1960's. The Dama Gazelle could have persisted there somewhat late, until about 1980, particularly in the Akle Aouana, near the Malian border (Sournia and Verschuren, 1990).

Mali: endangered

The Sahelian range of the Dama Gazelle crosses Mali from the Irrigi in the west to Azouak in the east, between 18° and 15° N., with an extension as far as 20°N., and to the Algerian border in the periphery of the sub-Saharan massif of the Adrar des Iforas (Lhote, 1946; Dupuy, 1967; Trotignon, 1975; Sayer, 1977; Newby, 1988; Heringa, 1990; Sidiyene and Trainer, 1990). Lhote (1946) notes its presence in the entire Sahelian steppe zone, including in the loop of the Niger river, in particular, in the region of Hombori, in the immediate vicinity of the present Elephant Reserve and at the latitude of the Ansongo-Menaka Reserve. The species survived, at the end of the 1970's and in the beginning of the 1980's, in the southern Sahelian regions of Gourma and Ansongo, to the west of the Adrar des Iforas, in the region of Araouane and near the Mauritanian border (Heringa, 1990), as well as perhaps in the Azaouak at the border with Niger (Grettenberger and Newby, 1990; Millington *et al.*, 1991). The numbers were estimated at more than one thousand in the beginning of the 1980's, at much lower figures, in decline, at the end of the 1980's (Heringa, 1990). Duvall *et al.* (1997), however, estimated the population to be several hundred strong and suggested a possible recent increase. A recent survey, conducted within the CMS/FFEM project, shows that circa 250 individuals are present in South Tamesna divided in two sub-populations (eastern and western) (Lamarque, com. pers., 2005).



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Niger: endangered

The Sahelian range of the Dama Gazelle crosses Niger from the Azaouak to the south of the Ténéré, between the 15th and 17th parallels (Lhote, 1946; Brouin, 1950; Grettenberger and Newby, 1986, 1990; Millington *et al.*, 1991; Dragesco-Joffé, 1993; Poilecot, 1996a, 1996b). In the 1940's, the principal concentrations were noted south of the Aïr (Lhote, 1946; Brouin, 1950). Brouin (1950) qualified the "very wooded" region of the Tadéras, between 15° 30' and 16° 30' latitude, and between 6° 30' and 9° longitude, as the preferred habitat of *Gazella dama*. The distribution has contracted considerably, and, in the 1980's, residual populations occupied a range, around the Aïr and the Termit on the one hand, around the Azaouak on the other hand (Grettenberger and Newby, 1990; Millington *et al.*, 1991). The population in Niger was estimated at less than 1000 individuals by Grettenberger and Newby (1990) and Millington *et al.* (1991) of which 150-250 were in the Aïr and 200-400 were in the Termit (Grettenberger and Newby, 1986, 1990; Millington *et al.*, 1991). Dragesco-Joffé (1993) evaluates a population of Niger reduced to 400 animals. Surveys conducted since 2000, indicate that Dama's population is mostly concentrated in the Termit (Claro, 2004, Wacher *et al.*, 2004) and could count ca 300 individuals (Wacher *et al.*, 2004).

Chad: endangered

The Dama Gazelle was distributed in Chad in the whole Sahelian belt, mainly between the 14th and 17th parallels, from the border with Niger in the west to the massifs of the Ouaddaï, the Kapka, the Ennedi, and the depression of the Mourdi along the eastern border (Malbrant, 1952; Newby, 1974; Thomassey and Newby, 1990). In the 1970's and 1980's, the species seems to have survived in its entire range, in reduced numbers however (Thomassey and Newby, 1990). The Ouadi Rimé-Ouadi Achim Reserve was one of the bastions of the species with a population estimated, in the middle of the 1970's, at 10,000 to 12,000 individuals (Newby, 1974). Currently, the species has become very rare in the Ouadi Rimé-Ouadi Achim Reserve (Pfeffer, 1993a, 1993b, 1995; Beudels *et al.*, 1994; Tubiana, 1996a, 1996b; Moksia and Reouyo, 1996) and throughout the Chadian Sahel. Nevertheless, a population of 50 to 100 individuals survives in the Manga region (Monfort *et al.*, 2004).

Sudan: extinct or on the edge of extinction

The Dama Gazelle was distributed at the beginning of this century in the entire Sahelian zone and the sub-desert valleys



of the Darfur, the Kordofan, and the south of the Northern Province, between 13° and 20° N (Sclater and Thomas, 1898; Audas, 1951; Wilson, 1980; Hillman and Fryxell, 1988). In the 1940's, it survived in all the regions where the Oryx did, north of 13° N, especially in the eastern Kordofan (Audas, 1951). In the 1960's and 1970's, small, very mobile groups of Dama Gazelles persisted in a large part of the north of the Darfur, from the Chadian border to the edge of the Kordofan, particularly in the region of the Wadi Howar at 16° 30' N and further south, towards 15° N (Wilson, 1980). The last precise observations date from the years 1975-1977. Two animals killed in January 1989 between Omdurman and the western Darfur by Middle Eastern hunting tourism are noted by Cloudsley-Thompson (1992). Today, the species is considered in danger of extinction if not extinct in the country, but precise information on its possible survival is lacking (Hillman and Fryxell, 1988; Hashim, 1996).

Senegal: extinct

The Dama Gazelle has been known since at least the 18th century in the Sahelian zone of Senegal (Sclater and Thomas, 1898). Sournia and Dupuy (1990) suppose, however, that it was only a dry season visitor. It seems to have been especially frequent in the zone of the Ferlo at the time of the Sahelian droughts of the 1970's (Sournia and Dupuy, 1990). There are no more recent data.

Burkina Faso: extinct or on the edge of extinction

Northern Burkina Faso, north of 14°, is in the southern Sahelian belt of deciduous shrubs or thickets (White, 1983). The Dama Gazelle was still present recently, though in reduced numbers (Heringa *et al.*, 1990). It could have survived in particular in the Seno-Mango area which is part in the Sahel Reserve (Heringa *et al.*, 1990).

Nigeria: probably extinct

Extreme northeastern Nigeria, in the region of Lake Chad and the Jawa, is situated in the southern Sahelian belt of deciduous shrubs or thickets (White, 1983; Anadu and Green, 1990). The Dama Gazelle was apparently rare there. There are no recent indications of presence (Anadu and Green, 1990).

4. Actual and potential threats

Like that of the Scimitar-horned Oryx, the decline of the Dama Gazelle has happened under the combined effect of several factors acting simultaneously: the anthropogenic degradation of habitats, arid-land environmental stochasticity, taking, and loss of habitat as a consequence of human pressure. These factors, which are still active today, do not differ in their overall description for the two species, whose principal ranges coincide.

4.1. Degradation and decline of habitats

Catastrophic droughts. In the context of aridity which has prevailed in the Sahara for 3,000 to 4,000 years (Le Houérou, 1986; Newby, 1988), years of increased drought, especially affecting the Sahel, occur at more or less long intervals (Monod, 1986). During the 20th century, severe Sahelian droughts happened in 1913-1914 (Monod, 1986), in 1940-1945 (Monod, 1986; Newby, 1988), then, with a particularly high frequency, in 1968-1973, 1976-1980, and 1983-1984 (Monod, 1986; Newby, 1988; Hassaballa and Nimir, 1991). These periods of drought necessarily have a catastrophic effect on the fauna of arid regions. The damage caused by recent episodes to palaeartic migratory birds wintering in the Sahel has been abundantly documented and commented upon. The effects of these natural catastrophes were deeply worsened by their occurrence in combination with anthropogenic factors. They indeed hit populations of Sahelian antelopes which had already been pushed by human pressure towards sub-desert zones at the limit of their tolerance for aridity. They forced them to re-shift southwards, to areas where the pressure of pastoralists and farmers is much stronger (Newby, 1988) and the risks of taking much higher (Newby, 1982). Moreover, the level of human occupation of the land compromises the prospects for reconstitution of the vegetation after periods of drought (Millington *et al.*, 1991).

Degradation of pastures by overgrazing. The capacity of the excellent livestock-raising areas in the sub-desert steppe to support an enormous primary production of gramineous and other perennial plants, combined with relatively weak competition and predation, explain the past abundance of ungulates (Newby, 1974). Sharp increases in domestic livestock and the possibility of permanent use of pastureland located in regions without water thanks to deep-well drilling, have led to the generalisation of intense overgrazing (Newby and Sayer, 1976; Newby, 1978a; Newby, 1988). For the entire northwestern Saharan and sub-Saharan regions, Le Houérou (1986) evaluates grazing pressure to be twice the



carrying capacity, and notes among its effects the elimination of perennial grasses and browsable shrubs, trampling and compaction of soils, their denudation and consequent eolian erosion. For the Sahel, Monod (1986) indicates grazing pressures of 0.8 to 1 sheep-equivalent per hectare, for a carrying capacity of 0.25 sheep-equivalent per hectare, a load four times too high, leading to severe and generalised overgrazing. The effects of such overexploitation are well described for the Sudan by Bari (1991) who documents the transformation of rich pastures of short grasses and perennials into absolute desert, and by Hassaballa and Nimir (1991) who note a 5 to 6 kilometres progression of the desert per year. The destruction of pastures, especially of formations of *Cornulaca*, by grazing has also been observed in Chad (Newby, 1974).

Felling of ligneous species. Ligneous species are essential for the Dama Gazelle, as much as or more than for the Oryx, both for the shade and the food. The Dama Gazelle is in fact a mixed user, more a foliage browser than a grazer on gramineous plants. The systematic destruction of trees and shrubs in the Sahelo-Saharan zone is a historical constant (Le Houérou, 1986). It has strongly increased recently in the southern fringe regions of the Sahara, under the combined effects of drought and needs for firewood and charcoal (Grettenberger and Newby, 1986; Newby, 1988; Bari, 1991; Hassaballa and Nimir, 1991; Millington *et al.*, 1991). In Sudan, for example, Bari (1991) documents the total disappearance of *Acacia tortilis*, *Acacia raddiana*, *Acacia senegal*, and *Maerua crassifolia* woodlands, and their replacement by absolute desert.

4.2. Direct exploitation.

Traditional hunting. Traditional modes of capture, either hunting (Brouin, 1950; Newby, 1974; Grettenberger and Newby, 1986; Dragesco-Joffé, 1993), or trapping, exercised by nomads in particular, certainly played a role in reducing the species, especially when it was done in conjunction with other factors and was practised at the expense of ecologically weakened populations.

Motorized hunting. Much more than forms of traditional capture, it is the development of taking using modern firearms and vehicles, including 4x4 vehicles, which was an essential proximal factor in the reduction or local extinction of the species. It was mainly perpetrated by military, mining, oil, or administrative personnel, expatriate or African (Grettenberger and Newby, 1986; Hassaballa and Nimir, 1991; Dragesco-Joffé, 1993).

Hunting tourism. As for all the Sahelo-Saharan antelopes, the massacres perpetrated by hunting tourism, in particular Middle-Eastern, which is well documented, especially for Sudan (Cloudsley-Thompson, 1992), Niger, and Mali (Newby, 1990; Bousquet, 1992), represent a major potential threat.

4.3. Other threats.

All the indirect human pressures likely to affect the species, such as the increase of ovine and caprine livestock, the increase in the number of wells, and the invasion of available habitats, are exerted through the deterioration or regression of habitats and the increase in susceptibility to taking. They have been treated under these points.



Gazella dama in the wild. Chad. Mission SSIG-SCF.
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5. Regulatory provisions

5.1. International.

Bonn Convention: Appendix I, resolution 3.2, paragraph 4.

Washington Convention (CITES): Appendix I



5.2. National.

The Dama Gazelle is completely protected in Mali, Niger, Senegal, Morocco, Algeria, Tunisia, and partially in Sudan.

6. Conservation measures, by party

6.1. Ban on takings.

Morocco:	protected
Algeria:	protected
Mali:	protected
Niger:	protected
Senegal:	protected

6.2. Habitat conservation.

Morocco

The proposed protected areas in the lower Drâa basin and in the Dakhla region (AEFCS 1995) appear to be appropriate for the reintroduction of the species. In both sites, the species is extinct. In the case of Dakhla, the protected area must extend sufficiently far into the interior, and in the region of the Adrar Souttouf, it must include a substantial representation of steppes and woodlands with a Sahelian physiognomy which characterised the range of *Gazella dama mohrr* (Valverde, 1957). It is possible however that *Gazella dama mohrr* still survives in a few isolated pockets in parts of its historical area of distribution Cuzin (1998), in particular along the Mauritanian border. If this is the case, efforts to protect the species, accompanied by restoration of its habitat, should of course be a priority.



Wadi after rain. Acacias. Niger. © John Newby

Algeria

The National Park of the Tassili des Ajjers and the Hoggar National Park offer, by their exceptional dimensions and their environmental diversity (Bousquet, 1992), unquestionable possibilities of redeployment of the Dama Gazelle. Here also, the possibility that the species still occurs in the wild must obviously be evaluated before launching any project of reintroduction.

Mauritania

Gazella dama mhorrr was present until the end of the 1960's in the Banc d'Arguin National Park.

Mali

The Elephant Reserve and the Ansongo-Menaka Reserve are situated in the zone of distribution of the Dama Gazelle (Lhote, 1946). In both reserves, populations of the species occurred until recently (Heringa, 1990; Pavy, 1996). Unfortunately, they are under considerable agricultural, pastoral, residential, and hunting pressures (Heringa, 1990).

The establishment of the protected areas of Tamesna, North Azawagh and West Zdjaret, where *Gazella dama* still occurs, could be an important contribution to the conservation of the species in Mali.

Niger

The Termit massif, which, at least recently, harboured the largest populations of the Dama Gazelle, is one of the best preserved regions of the Sahel in Niger, with the environment in relatively good condition (Newby, 1982, 1988; Grettenberger and Newby, 1986, 1990; Millington *et al.*, 1991). The national park planned there is essential for the species. The Air-Ténéré National Park also shelters substantial populations; the implementation of conservation measures runs up against difficult practical problems but its effective protection remains an essential element of a network of protected areas (Newby and Jones, 1986; Grettenberger and Newby, 1986, 1990; Millington *et al.*, 1991). The Gadabedji Reserve, created for the protection of Sahelo-Saharan antelopes, mainly the Scimitar-horned Oryx, had Dama Gazelles at the time of its creation. Unfortunately, human pressures have never been sufficiently controlled there (Newby, 1982; 1988; Dixon and Newby, 1989; Grettenberger and Newby, 1990; Millington *et al.*, 1991). It is a potential site of reintroduction if these pressures can be held in check and if the programme of habitat rehabilitation which was undertaken in 1989 (Millington *et al.*, 1991) is successful.

Chad

The Dama Gazelle might still survive in the Ouadi-Rimé-Ouadi Achim Reserve where its population in the mid-1970's totalled 10,000-12,000 individuals (Newby, 1974). However, its situation has sharply deteriorated since the end of the 1970's (Thomassey and Newby, 1990; Dragesco-Joffé, 1993; Pfeffer, 1993a, 1995; Moksia and Reouyo, 1996).

Sudan

The proposal to create a national park in the Wadi Howar in the northern Darfur could offer good possibilities of conservation or recolonisation for the Dama Gazelle (Hashim, 1996).

Senegal

The North Ferlo Reserve (Bille *et al.*, 1972; Bille and Poupon, 1972; Sournia and Dupuy, 1990) offer possibilities of recolonisation or reintroduction for Sahelian antelopes. The designation as national parks is under consideration (Diop *et al.*, 1996). A programme to reintroduce the Dama Gazelle is going on (Sournia and Dupuy, 1990; Diop *et al.*, 1996). Its success depends mainly, as for all the southern Sahelian localisations, on the chances of limiting human pressure so as to ensure the protection of the animals and the rehabilitation of the vegetation (Diop *et al.*, 1996). In October 2005, there are 6 Dama in the Ferlo North with only one birth in 2005 (Jebali, October 2005. comm.pers.).

Burkina Faso

Dama Gazelles may survive in the partial fauna reserve of the Sahel, in particular in the Seno-Mango area. The reserve has suffered much from grazing, wood cutting and drought (Heringa *et al.*, 1990).

6.3. Attenuation of obstacles for migratory animals.

The creation of a network of sufficiently close protected areas, numerous and large enough, and particularly of crossborder reserves, can, in the medium term, ensure adequate movement security for this relatively small and discreet species. Among the priorities would appear to be the creation of a reserve in Mali in the Adrar



Gazella dama, in a large enclosure within North Ferlo Reserve (RFFN). Senegal. 2005. © Abdelkader Jebali. MNHN

des Iforas, in relation with the parks in southern Algeria and in Tamesna in continuity with the Niger Tamesna and the rehabilitation of western Algerian acacia woodlands in the zone of possible population expansion of *Gazella dama mohrr* in the Drâa basin.

6.4. Regulations concerning other detrimental factors.

These possible regulations only have meaning within a framework of management plans for protected areas. This point consequently merges with point 6.2.

6.5. Other measures.

Morocco

Animals from Almeria (Spain) were introduced within the fenced R'mila protected area (Marrakech region), where there are now several dozen individuals, as well as within the fenced Rokkeïn protected area (Souss-Massa National Park), where there are about 10 individuals (2005). These semi-captive animals could be part of a reintroduction programme in the Saharan region in the future.

Tunisia

A programme to introduce the species exists (Kacem *et al.*, 1994).

Senegal

A reintroduction programme in North Ferlo Reserve is underway. Six dama gazelles were introduced in the 600 ha enclosure within North Ferlo Reserve in January 2003. (Sournia and Dupuy, 1990; Diop *et al.*, 1996; Jebali, 2005).

Outside range of distribution

The species is raised in captivity or semi-captivity in North Africa, the Middle East, Europe, and North America. Stocks include specimens of *Gazella dama mohrr*, originating from the ex-Spanish Sahara then from the Almeria animal husbandry center.

7. Research activities

7.1. Public authorities.

7.2. N.G.O.s

8. Needs and recommended measures

Recommended measures are detailed in ASS-CMS Action Plans (Beudels *et al.*, 1998). The principal needs that they meet are listed below.



Gazella dama reintroduced. Guembeul. Senegal. 2005.
© Mar Cano. EZZA

8.1. Total protection of the species.

Necessary in all the countries of the present and historical range so as to preserve the surviving populations and prepare for a possible redeployment.

8.2. Conservation measures.

Establishment of a network of protected areas in all the parts of the historical range, with absolute priority to the areas where the species survives or may survive in the wild. Adequate management of these areas to re-establish favourable ecological conditions.

8.3. Localization, monitoring of residual populations and definition of their ecological requirements.

Determined search for possible residual populations of *Gazella dama mohrr*. Study of the principal surviving Sahelian populations, mainly in Niger, Mali, Chad; evaluation of their current status and the ecological conditions they encounter.

8.4. Reinforcement of populations and reintroduction into the potential range.

Assistance to the Senegalese reintroduction programme. Possible preparation of programmes in other regions of the historical range, after evaluation of the chances of natural survival without reinforcement, and the chances of success of reinforcement or reintroduction efforts. It is principally in the Atlantic range of *Gazella dama mohrr* that this type of measure could be applied.



Training. South-Tamesna.Mali. 2005 © François Lamarche-ONCF



Gazella dama. Guembeul Reserve. Senegal. © Koen De Smet



Gazella dama. Engraving, tracks and habitat. Niger © John Newby



Tassili N'Ajjer : Erg Tihodaïne. Algeria. © François Lecouat

Gazella leptoceros



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Gazella leptoceros. Enclosure. Djebil NP. Tunisia. 2005.
© Tania Gilbert. Marwell Preservation Trust.

Drawing : Gazella leptoceros. J.Smit in Sclater & Thomas, 1899



Gazella leptoceros

1. TAXONOMY AND NOMENCLATURE



Gazella leptoceros. Sidi Toui National Parks. Tunisia.
© Renata Molcanova

1.1. Taxonomy.

Gazella leptoceros belongs to the tribe Antilopini, sub-family Antilopinae, family Bovidae, which comprises about twenty species in genera *Gazella*, *Antilope*, *Procapra*, *Antidorcas*, *Litocranius*, and *Ammodorcas* (O'Reagan, 1984; Corbet and Hill, 1986; Groves, 1988). Genus *Gazella* comprises one extinct species, and from 10 to 15 surviving species, usually divided into three sub-genera, *Nanger*, *Gazella*, and *Trachelocele* (Corbet, 1978; O'Reagan, 1984; Corbet and Hill, 1986; Groves, 1988). *Gazella leptoceros* is either included in the sub-genus *Gazella* (Groves, 1969; O'Reagan, 1984), or considered as forming, along with the Asian gazelle *Gazella subgutturosa*, the sub-genus *Trachelocele* (Groves, 1988). The species comprises two sub-species, *Gazella leptoceros leptoceros* of the Western Desert of Lower Egypt and northeastern Libya, and *Gazella leptoceros loderi* of the western and middle Sahara. These two

forms seem geographically isolated from each other and ecologically distinct, so that they must, from a conservation biology point of view, be treated separately.

1.2. Nomenclature.

1.2.1. Scientific name.

Gazella leptoceros (Cuvier, 1842)
Gazella leptoceros leptoceros (Cuvier, 1842)
Gazella leptoceros loderi (Thomas, 1894)

1.2.2. Synonyms.

Antilope leptoceros, *Leptoceros abuharab*, *Leptoceros cuvieri*, *Gazella loderi*, *Gazella subgutturosa loderi*, *Gazella dorcas*, var. 4

1.2.3. Common names.

English: Slender-horned Gazelle, Loder's Gazelle, Sand Gazelle, Algerian Sand Gazelle, Rhim
French: Gazelle leptocère, Gazelle des sables, Gazelle des dunes, Gazelle blanche, Rhim, Gazelle à longues cornes
German: Dünengazelle
Arabic: Rhim
Tamacheq: Hankut, Edemi

1.2.4. Description

A medium-sized gazelle with a very pale yellowish beige back, separated from the white belly by a slightly darker band on the flank. The face and neck are concolourous with the back. Facial markings are faint. The ears are long and narrow. Horns are long, erect, divergent and nearly straight in both sexes. (Groves, 1988), with 20-25 well-defined rings. They are appreciably thicker and longer in males, up to 350-400mm. Outer hooves are broader than the inner ones. (Kingdon, 1997), the widening of the surface facilitating movements on sand (LeBerre, 1990). The rump patch is white with very little outline. The tail is short, terminated by a tuft of black hair.



The Slender-horned Gazelle is a poorly known species, compared with the other gazelles.

TL (male and female): 100 (90-110) cm

T (male and female): 15-20 cm

Height: 65-72 cm

Mass (male): 24 (20-27) kilos

Mass (female): 16 (14-18) kilos

Horns : (Groves, 1969)

G.l.leptoceros M 337.3 ± 28.3 (n=6); F: 273 (n=2)

G.l.loderi M 297.5 ± 15.8 (n=6); F: 248.4 ± 19.0 (n=5)

2. BIOLOGY OF THE SPECIES

2.1. General Biology

2.1.1. Habitat.

Gazella leptoceros leptoceros occupies *Acacia raddiana* woodlands, sandy outskirts of oases supporting *Nitraria retusa*, and interdunal depressions with *Cornulaca monacantha* (Osborn and Helmy, 1980). It consumes a significant amount of foliage (Saleh, 1997). *Nitraria retusa*, a halophyte plant, *Pituranthos tortuosus*, *Acacia raddiana*, *Cornulaca monacantha*, *Launaea capitata*, and *Calligonum comosum* are part of its diet (Osborn and Helmy, 1980). The Slender-horned Gazelles are mostly twilight and nocturnal animals, eating and moving during these periods of the day, and resting during the hot hours in the shade or in hollowed-out depressions (Osborn and Helmy, 1980).

Gazella leptoceros loderi is principally linked to ergs (Schnell, 1977; White, 1983, units 69, 70, 71; Ozenda, 1991) which seem to constitute its only habitat, at least in the central Sahara (Sclater and Thomas, 1898; Lavauden, 1926; Heim de Balsac, 1936; Dupuy, 1967). It mainly grazes on *Aristida pungens* (Heim de Balsac, 1936) but it also uses plants with a high hydric content, such as *Anabasis articulata*, *Arthrophytum schmittianum*, *Helianthemum kahiricum*, and the fruits of *Colocynthis vulgaris*, to meet its water needs (Kacem *et al.*, 1994).

2.1.2. Social behaviour.

Gazella leptoceros lives in small groups of 3-4 individuals, consisting generally in an adult male, several adult females and their offsprings. Solitary individuals, couples, and clubs of young males are also observed. Gestation lasts 165 days. Twin births are common.

2.2. Distribution.

Endemic of the sand-dune (erg) regions of the Sahara, west of the River Nile.

2.2.1. Historical distribution.

Gazella leptoceros leptoceros is characteristic of and almost endemic to the northern part of the Egyptian Western Desert. It seems linked to the great oases formed in aeolian depressions reaching the water table, a land feature characteristic of this desert, and to the interdunal valleys populated with acacias (Flower, 1932; Osborn & Helmy, 1980; Ayyud & Ghabbour, 1986; Le Hou  rou, 1986; Goodman *et al.*, 1986; Saleh, 1987, 1997; Zahran & Willis, 1992). It is or was noted in Siwa in the northwest, the Quattara depression, Wadi Natroun and Wadi el Ruwayan near the lower Nile, in the Nile valley, in dune fields between Faiyum and the Quattara depression (Osborn & Helmy, 1980), in Bahariya (Saleh, 1987), and in Kharga (Elbadry, 1998). It has also been found in the same chain of oases beyond the Libyan border in Jaghbug (Bundy, 1976; Essghaier, 1980; Goodman *et al.*, 1986). The Slender-Horned Gazelles noted more to the west in Libya, in particular near Ajdabiyah in western Cyrenaica and near Dahra, north of Zella (Hufnagl, 1972; Essghaier, 1980), may also belong to the nominal form.





Gazella leptoceros. Enclosure. Sidi Toui and Oued Dekouk NP. Tunisia.
 © Renata Molkanova & Roseline.Cl. Jamar- Beudels. IRScNB



Gazella leptoceros. Male. Female and her fawn. Young born in Sidi Toui National Park. Tunisia. © Renata Molcanova



Gazelles leptocère (Rhim) en semi-captivité dans l'enclos se situant à 180 km au Sud de Br»zina dans la province d'El Bayadh, au Sud-Est d'Alger. 2002. Algérie. © Amina Fellous - ANN

Gazella leptoceros loderi is a typically Saharan antelope, linked to sand deserts, and characteristic of the central Sahara (Dragesco-Joffé, 1993). Its distribution does more or less coincides with that of the large zones of Saharan ergs (Walter & Breckle, 1986). Loder's Gazelle seems however to be absent in the westernmost complexes, to have its principal distribution in the central archipelago, and to be rare or absent in the southeast periphery. In the west, it has not been found either in the great dunal group, mostly Mauritanian, of the Ouarane-Djouf-Majâbat Al-Koubra, or in the Algero-Mauritanian group of the Iguidi and Chech ergs (Lavauden, 1926; Monod, 1958; Dupuy, 1967; De Smet, 1989; Kowalski & Rzebik-Kowalska, 1991; Dragesco-Joffé, 1993). The only observation of *Gazella leptoceros* in Morocco comes from the region of Boumia southeast of the High Atlas during the 1950's (Loggers *et al.*, 1992). This record, situated outside the species' habitat, corresponds to the movements of large amplitude observed in years of great drought (Heim de Balsac, 1928). The center of gravity of the distribution of *G.l.loderi* is located in the Great Western Erg, the Great Eastern Erg, the sandy zone which stretches from the Hamada de Tinrhert in Algeria to the Fezzan in Libya, and the smaller ergs in the periphery of the central Saharan massifs of the Hoggar and the Tassili des Ajjers, in particular the Ahmer erg (Setzer, 1957; Dupuy, 1967; De Smet, 1989; Kowalski & Rzebik-Kowalska, 1991; Dragesco-Joffé, 1993; Kacem *et al.*, 1994; Khattabi & Mallon, 1997), a region where its presence has long been known and in which it was thought limited (Sclater & Thomas, 1898; Trouessart, 1905; Lavauden, 1920, 1926; Joleaud, 1929). Its distribution in the ergs surrounding the massifs of the Hoggar and the Tassili could extend to Mali in the Tanezrouft (De Smet, 1989) and to the vicinity of the Adrar des Iforas (Pavy, 1996). In the ergs of the southern and eastern Sahara, data are very few, either because the species is very rare, or because of the difficulties of observation. Precise data are grouped in three regions: the Ténéré in Niger, the periphery of the Tibesti, and the ergs which lay from the Borkou in northeastern Chad to southeastern Libya. The Great Ténéré Erg is poor in vegetation, yet a plant community is growing there which is similar to the formations of *Aristida*, *Cornulaca*, and *Calligonum* in the central Sahara (Quézel, 1965; Ozenda, 1991), formed by the perennial graminids *Stipagrostis acutiflora*, *S. plumosa*, *S. uniplumis*, *S. vulnerans*, *Cyperus conglomeratus*, the suffrutescent *Moltkiopsis ciliata*, and the ligneous *Cornulaca monacantha* (Poilecot, 1996a, annex 17). Jones (1973) and Newby observed the species there, in small numbers, on the edge of the Aïr (Jones, 1973; Grettenberger & Newby, 1990; Poilecot, 1996b). In the Tibesti, the species was noted by Malbrant (1952) near Bardai and Soborom, in the north of the massif. A small number of data, relatively indirect, delimit an area of presence between the zone of the Erdi and the Mourdi depression in the Borkou of northeastern Chad and the Jebel Uweinat at the borders of Libya, Sudan, and Egypt. This is a region in which a number of dunal systems stretch more or less from southwest to northeast. At the Chadian extremity of this zone, Edmond-Blanc *et al.* (1962) gathered, secondhand, some indications of presence. At the Libyan extremity, Misonne (1977) found three skulls on the border of the Jebel Uweinat massif. Recent data also exist from the Gilf El Kebir in Egypt (Elbadry, 1998). The subspecific affinities of these southern and southeastern animals are not known, but what is known of their ecology brings them close to *G. l. loderi*. Outside these regions, hypotheses of presence exist but apparently not observations. Mentions of it in Mali (Heringa, 1990; Duvall *et al.*, 1997) are based on its inclusion in a table by Newby (1982) without there seeming to be any data, except perhaps from nearby Algerian regions. Sayer (1977) and Sidiyène & Tranier (1990) indicate its absence in the entire country, and in the Adrar des Iforas in particular. Mentions of it in Sudan (Wilson, 1980) come from an optimistic interpretation of Edmond-Blanc *et al.*'s data from Chad (1962).

2.2.2. Decline of the range.

Gazella leptoceros leptoceros has vanished from most of its range in the Egyptian Western Desert. In the 1980's, the species was considered extinct in 5 of its 6 known localities in the eastern part of the Western Desert and very rare in the last, the complex of the Wadi el Ruwayan and its extension, the Wadi Muweilih, where a small group of about 15 animals was surviving; this group was later exterminated (Saleh, 1987, 1997). In the western part of the desert, around the Quattara depression and the Siwa oasis, its status was uncertain (Saleh, 1987). The situation was not known, either, in Libya, where in the 1970's, Essghaier (1980) noted groups of 10 to 20 around Jaghbug.

For *Gazella leptoceros loderi* there is no objective indication of range contraction. There are however incontestable signs of decreasing numbers.

2.2.3. Residual distribution.

Gazella leptoceros leptoceros might be surviving west of the Siwa oasis (Elbadry, 1998), perhaps also around the Quattara depression (Saleh, 1987, 1997; Elbadry, 1998), the Jaghbug oasis, and the Kharga oasis (Elbadry, 1998).

According to Essghaier, two populations still survive in 2005: one on the Egyptian border, in the Al Jaghbug region, the other in the centre of the country in the area of Al Haruj al Aswad (Lamarque, pers. com.).

There are relatively recent observations in most of the historical zones of distribution of *Gazella leptoceros loderi*. In Algeria, the species is distributed east of a line Saoura - Wadi Messaoud, in the Great Western Erg, the Great Eastern Erg,

the Hamada de Tinrhert, and the smaller ergs around the central Saharan massifs of the Hoggar and the Tassili des Ajjers, in particular the Ahmer erg (Sclater & Thomas, 1898; Trouessart, 1905; Lavauden, 1926; Joleaud, 1929; Dupuy, 1967; De Smet, 1989; Kowalski & Rzebik-Kowalska, 1991; Dragesco-Joffé, 1993). In Tunisia, *Gazella leptoceros loderi* is present in unknown numbers, probably relatively low, in the Great Eastern Erg (Lavauden, 1920; Dragesco-Joffé, 1993; Kacem *et al.*, 1994). In Libya, the distribution of central Saharan populations of *Gazella leptoceros loderi* includes the sandy zones of the Fezzan where there have been recent observations (Setzer, 1957; Hufnagl, 1972; Khattabi & Mallon, 1997). The species probably still occurs in Mali. The range of populations of *Gazella leptoceros loderi* living in the ergs surrounding the massifs of the Hoggar and the Tassili indeed probably extends as far as Mali in the Tanezrouft (De Smet, 1989) and in the vicinity of the Adrar des Iforas (Pavy, 1996).

2.2.4. Recolonisation prospects.

Gazella leptoceros leptoceros

The habitats in most of the oases of the Lybian Desert of Egypt have been profoundly modified by agriculture and urbanization (Goodman *et al.*, 1986). For a small species linked to the dunes and the peripheral acacia formations, it is probable that sufficient potentialities have survived around most of them (Saleh, 1987). Some of these have nevertheless been gravely affected by major infrastructure work (Saleh, 1987, 1997). The Siwa oasis is probably a particularly important site, for this species as for other antelopes. The two areas mentioned by Essghaier, the regions of Al Jaghub and Al Haruj al Aswad, should also be prospected.

Gazella leptoceros loderi

The erg habitat which Loder's Gazelle prefers is affected relatively little by the anthropic pressures that bear on most of the Sahelo-Saharan region, although Le Houérou (1986) and Karem *et al.* (1993) note the mutilation of ligneous species for firewood. The reoccupation of possibly lost range would thus not seem very difficult, especially since the species has a high rate of reproduction and exhibits migratory or erratic behaviour, two characteristics that suggest a reasonable colonisation potential. Locally, restoration of the vegetation cover might be necessary, and in all cases protection against human predation and excessive disturbance should be ensured.

2.3. Evolution and estimation of populations.

At the beginning of the 1980's, *Gazella leptoceros leptoceros* was only surviving in small, widely dispersed groups, especially near uninhabited oases and in the Wadi El Rayan (Saleh, 1987). The numbers which seem to survive in the Egyptian northwest and perhaps in Kharga are certainly very low (Elbadry, 1998). It is probably the same for the possible remnant Libyan populations.

Population size of *Gazella leptoceros loderi* is very difficult to estimate. It seems clear, however, that it was much more abundant in the Algeria-Tunisia Great Ergs at the end of the 19th century and at the beginning of the 20th century than it has been in recent years. Large numbers were found, apparently relatively easily, by several naturalists of this period (Sclater & Thomas, 1898; Lavauden, 1926; Heim de Balsac, 1928, 1936) whereas Le Houérou (1986) notes having seen only one throughout twenty-five years of prospecting for mapping the vegetation of North Africa.

2.4. Migration.

Loder's Gazelle and the Slender-horned Gazelle move frequently between desert depressions in search for food (Kacem *et al.*, 1994; Saleh, 1997). Larger movements, likely to carry the species far from its preferred habitat, take place under the effect of long and severe droughts (Heim de Balsac, 1928).

These migrations have a cross-border character, at least between Algeria and Tunisia and between Egypt and Libya. It is also possible between Algeria and Mali, between Libya and Chad, and perhaps between Libya, Egypt or Chad and the Sudan.

3. CONSERVATION STATUS, BY PARTY

IUCN : RedList of Threatened Species 2004 : EN C1 + 2a

Morocco: accidental

The only observation of *Gazella leptoceros* in Morocco is from the region of Boumia, southeast of the High Atlas, during the 1950's (Loggers *et al.*, 1992). This record, situated outside the species' habitat, corresponds to the movements of large amplitude observed in years of great drought (Heim de Balsac, 1928).

Algeria: probably endangered

The centre of gravity of the range of *Gazella leptoceros loderi* is in Algeria, east of a line Saoura - Wadi Messaoud, in the Grand Erg Occidental, the Grand Erg Oriental, the Hamada de Tinrhert, and the smaller ergs around the central Saharan massifs of the Hoggar and the Tassili des Ajjers, in particular the Ahmer erg (Sclater and Thomas, 1898; Trouessart, 1905; Lavauden, 1926; Joleaud, 1929; Dupuy, 1967; De Smet, 1989; Kowalski and Rzebik-Kowalska, 1991; Dragesco-Joffé, 1993).

Tunisia: probably endangered

Loder's Gazelle is present in unknown, probably relatively low, numbers in the Grand Erg Oriental (Lavauden, 1920; Dragesco-Joffé, 1993; Kacem *et al.*, 1994).

Libya: probably endangered

The distribution of central Saharan populations of *Gazella leptoceros loderi* includes the sandy zones of the Fezzan, where there have been recent observations (Setzer, 1957; Hufnagl, 1972; Khattabi and Mallon, 1997). *Gazella leptoceros leptoceros* is noted in the surroundings of the Jaghub oasis, where small groups have been observed (Essghaier, 1980). Slender-horned Gazelles noted more to the west in Libya, in particular, near Ajdabiyah in western Cyrenaica and near Dahra, north of Zella (Hufnagl, 1972; Essghaier, 1980), may also belong to the nominate form.

Egypt: endangered

The principal range of *Gazella leptoceros leptoceros* was situated in the northern part of the Egyptian Western Desert (Flower, 1932; Osborn and Helmy, 1980; Ayyud and Ghabbour, 1986; Le Houérou, 1986; Goodman *et al.*, 1986; Saleh, 1987, 1997; Zahran and Willis, 1992). It is or was noted in Siwa in the northwest, in the Quattara Depression, Wadi Natroun and Wadi el Ruwayan near the lower Nile, in the Nile Valley, in dune systems between Faiyum and the Quattara Depression (Osborn and Helmy, 1980), in Bahariya (Saleh, 1987), and in Kharga (Elbadry, 1998). It seems to survive west of the Siwa oasis (Elbadry, 1998), perhaps also around the Quattara Depression (Salet, 1987, 1997; Elbadry, 1998) and the Kharga oasis (Elbadry, 1998). *Gazella leptoceros loderi* perhaps survives in small numbers in the extreme southwest of the country (Saleh, 1987, 1997; Elbadry, 1998).

Mali: status uncertain

The population of *Gazella leptoceros loderi* living in the ergs surrounding the massifs of the Hoggar and the Tassili probably extend as far as Mali in the Tanezrouft (De Smet, 1989). The one mentioned in the vicinity of the Adrar des Iforas (Pavy, 1996) is now probably extinct (Lamarque, com. pers.).

Niger: probably endangered

The species was noted in small numbers in the contact zone between the Aïr and the Ténéré (Jones, 1973; Grettenberger and Newby, 1990; Poilecot, 1996b).

Chad: probably endangered

The species seems rare in Chad where it is noted in two regions, the north of the Tibesti (Malbrant, 1952) and the region of the Erdi and the Mourdi depression in the Borku (Edmond-Blanc *et al.*, 1962; Thomassey and Newby, 1990). There do not seem to be recent data in either of these regions.

4. ACTUAL AND POTENTIAL THREATS

4.1. Degradation and decline of habitats.

Gazella leptoceros leptoceros

The subspecies occupies habitats (acacia woodlands, dunes surrounding oases) which are directly threatened by human pressure. Projects of putting desert depressions under water (Quattara, Wadi El Rayan) are a direct and indirect threat to some of the most important habitats for the survival of residual populations of this subspecies.

Gazella leptoceros loderi

The habitats of this subspecies are less sensitive to human pressure than those of other Sahelo-Saharan antelopes. However, Le Houérou (1986) and Karem *et al.* (1993) document clear cases of overexploitation and degradation of erg vegetation, especially its ligneous components.

4.2. Direct exploitation.

The decline of *Gazella leptoceros loderi* and the near extinction of *Gazella leptoceros leptoceros* have to be attributed primarily to uncontrolled hunting (Saleh, 1987, 1997; Kacem *et al.*, 1994). Traditional hunting could have had a substantial impact on local populations (Sclater and Thomas, 1898) but it is modern hunting with firearms and motor vehicles (Newby, 1990) which constitutes the primary threat, likely to drive the species to extinction.

4.3. Other threats.

There are no other known threats.

5. REGULATORY PROVISIONS

5.1. International.

Bonn Convention: Appendix I, Resolution 3. 2, paragraph 4.
Washington Convention (CITES): Appendix III (Tunisia)

5.2. National.

Totally protected in Algeria, Tunisia, Libya, Egypt, and Niger



Training © Marie-Odile Beudels-IRScNB.

6. CONSERVATION MEASURES,

6.1. Ban on taking.

Algeria:	protected
Tunisia:	protected
Libya:	protected
Egypt:	protected
Niger:	protected



Niger. Sand, dunes and accacia. © John Newby..

6.2. Habitat conservation.

Algeria

The Hoggar and the Tassili des Ajjers National Parks probably have populations of the species (Bousquet, 1992) or would be capable of harbouring them.

Tunisia

Djebil National Park was designated especially for the conservation of the species (Dragesco-Joffé, 1993; Kacem *et al.*, 1994).

Niger

The species is present in the Aïr-Ténéré National Nature Reserve (Poilecot, 1996b).

6.3. Attenuation of obstacles for migratory animals.

Only protection within a network of protected areas, especially cross-border protected areas, is plausible.

6.4. Regulations concerning other detrimental factors.

Such regulations can only be taken within a framework of management plans for protected areas. This paragraph consequently merges with paragraph 6.2.

6.5. Other measures.

The species appears to exist in captivity in about twenty institutions in North Africa, Europe, and North America. It does not seem that the sub-species *Gazella leptoceros leptoceros* is part of this stock of mainly Tunisian origin (Kingswood, 1995, 1996).

7. RESEARCH ACTIVITIES

7.1. Public authorities.

7.2. N.G.O.s

8. NEEDS AND RECOMMENDED MEASURES

Recommended measures are included in the CMS Action Plan (Beudels *et al.*, 1998).



Gazella leptoceros. Enclosure. Djebil NP. Tunisia. 2005.
© Tania Gilbert. Marwell Preservation Trust.





The Chambi massif is part of the tunisian dorsale. It is constituted by a remarkable succession of vegetation communities with green oaks towards the summit, Aleppo pines on the slopes and alfa steppes in the piemont. Tunisie. 2002 © R.C.Beudels IRScNB

Gazella cuvieri



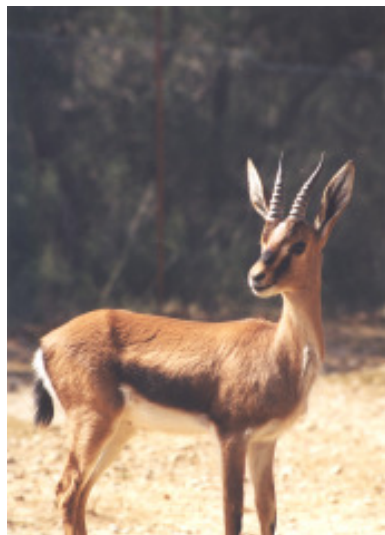
René-Marie Lafontaine, Roseline C. Beudels-Jamar and Pierre Devillers
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Drawing : Gazella cuvieri. J.Smit in Sclater & Thomas, 1899



Gazella cuvieri

1. TAXONOMY AND NOMENCLATURE



1.1. Taxonomy.

Gazella cuvieri belongs to family Bovidae, subfamily Antilopinae, tribe Antilopini, which comprises about twenty species in genera *Gazella*, *Antilope*, *Procapra*, *Antidorcas*, *Litocranius*, and *Ammodorcas* (O'Regan, 1984; Corbet & Hill, 1986; Groves, 1988). Genus *Gazella* comprises one extinct species, and from 10 to 15 surviving species, usually placed in three subgenera, *Nanger*, *Gazella*, and *Trachelocele* (Groves, 1969, 1988; Corbet, 1978; O'Regan, 1984; Corbet & Hill, 1986). *Gazella cuvieri* is generally included in the subgenus *Gazella* and considered a monotypic species (O'Regan, 1984; Corbet and Hill, 1986). Groves (1969) treated it as a northern representative of the Sahelo-Sudanese gazelle *Gazella rufifrons*, but later (Groves, 1988) confirmed, on the contrary, its isolation in the genus *Gazella*, and made it the only element in one of the five groups into which he divides this difficult genus.

Gazella cuvieri. Tunisie. © R.Cl. Beudels-Jamar - IRScNB

1.2. Nomenclature.

1.2.1. Scientific name.

Gazella cuvieri (Ogilby, 1841)

1.2.2. Synonyms.

Antilope corinna, *Antilope cuvieri*, *Gazella vera*, *Gazella cineraceus*, *Gazella kevela*, *Dorcas subkevela*, *Dorcas setifensis*

1.2.3. Common names.

English: Cuvier's Gazelle, Edmi Gazelle, Edmi, Atlas Mountain Gazelle

French: Gazelle de Cuvier, Gazelle de montagne

German: Echtgazelle

Arabic: Edmi, Ledm or Edem (Algeria and Tunisia), Dama (Eastern Morocco), Harmouch (South-western Morocco)

1.2.4. Description.

Cuvier's Gazelle is a fairly robust gazelle, larger than the Dorcas and Slender-horned Gazelles. The hair is rather long, rough and coarse. The general colour of the coat is dull fawn, darker than that of the Dorcas Gazelle. Face markings are distinct. The central band is brownish fawn, with a black patch on the top of its nose. The front of the muzzle is white. A dark line joints the mouth to the eye. There is a brown band, darker than the back, along the flanks. The belly and rump patch are white, the rump patch surrounded by a fairly indistinct dark band. The tail is black. The horns are long (25-37 cm), thick in the male, strongly annulated, fairly straight, rising vertically before diverging slightly out and back; the smooth tips curving in and forwards. (Slater and Thomas, 1897; Groves, 1988; Kingdon, 1997). Shoulder and hindquarter heights are similar (Panouse 1957). Females are smaller than males (average weight for female = 30 kg, for male = 35 kg, Abaigar, comm. pers.).

TL (male and female): 105-116 cm;

T (male and female): 19 - 21 cm;



Greatest length of skull about 20 cm; facial stripes well marked; males without a swelling on the throat (N.W Africa) (Corbet, 1978).

H: 60-80 cm

Shoulder height: up to 68 cm

Pp: 33 cm; Ear: 17 cm;

Weight : 15-35 kg; Female: 15 - 20 kg (33 - 44 lb); Male: 20 - 35 kg (44 - 77 lb).

Horns: 309.7 +/- 21.1¹ (3 Males); 204.2 +/- 22.8 (6 Females) Groves, 1969

Trophy: Record 378 mm, Algeria, G.K. Whitehead.

2. BIOLOGY OF THE SPECIES

2.1. General Biology

2.1.1. Habitat.

Cuvier's Gazelle occurs from sea level to an altitude of 2.600 m (Cuzin, 2003). It lives mainly in hills and low mountains, but may frequent piedmont plains as well as very steep slopes, of up to 45° (Cuzin, 2003). It avoids heavy snow cover areas, where it may be present only in summer (Cuzin, 2003). The species seems mainly characteristic of the middle and low slopes of the folds in the Maghreb, occupying the relatively dry forests of semi-arid Mediterranean type dominated by *Pinus halepensis*, *Juniperus phoenicea*, *Tetraclinis articulata*, *Cedrus atlantica*, *Quercus ilex*, *Argania spinosa* and perhaps, before their destruction, *Olea europaea*, with an undergrowth of maquis or garrigue which can be relatively thick or relatively open, and often includes *Rosmarinus officinalis*, *Phyllirea angustifolia*, *Pistacia lentiscus* and *Globularia alypum* (Sclater & Thomas, 1898; De Smet, 1989, 1991; Karem *et al.*, 1993; Kacem *et al.*, 1994, Cuzin, 2003, Abaigar, comm. pers.). In arid Mediterranean climate, it also frequents steppes of *Stipa tenacissima* and *Artemisia herba-alba* (De Smet, 1991; Karem *et al.*, 1993), and various other kinds of steppes (Cuzin, 2003). These forests were formerly much more widespread (Le Houérou, 1986); steppes of *Stipa tenacissima* constitute the first stage of substitution and have themselves greatly regressed (Le Houérou, 1986). In the Saharan part of its range its distribution appears limited to *Argania spinosa* and *Acacia* spp. woods (Cuzin, 2003).

2.1.2. Social behaviour and food preferences.

Cuvier's Gazelle lives in small groups of 5- 6 individuals, or solitary. It favours young alfa shoots (*Stipa tenacissima*), and other grasses, young leaves of leguminous plants and Holm Oak's acorns (*Quercus ilex*). Cuvier's Gazelle needs to drink regularly. Gestation lasts around 170 days. Births, usually of a single calf, occur in April and May.

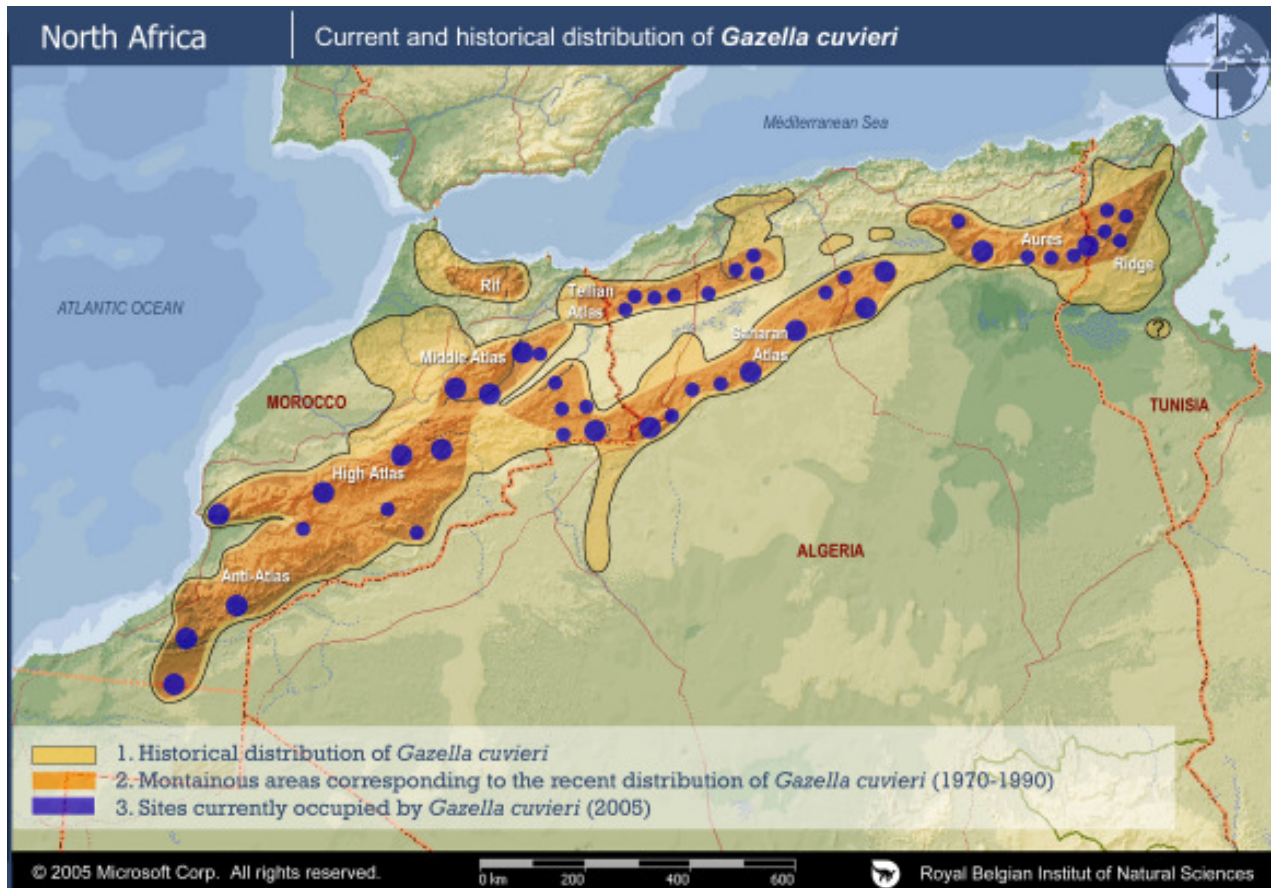
2.2. Distribution.

Atlas and neighbouring ranges in Morocco, Algeria and Tunisia, to the lowlands in western Morocco.

2.2.1. Historical distribution.

Cuvier's Gazelle is a species endemic to the mountain and hill ranges of the Maghreb. Its historical range locally reached the Mediterranean and Atlantic coast (e.a. Ben Slimane and the Ajou Mountains). In Morocco, it occupies all the mountain chains (eastern Rif, Middle Atlas, Great Atlas, westernmost Saharan Atlas, Anti-Atlas, pre-saharian mountains, Aydar south of the Drâa) and the associated plateaux with the exception of the western Rif. In Algeria it occupies or occupied the slopes of the Tellian chains, those of the more southern massif formed by the Saharan Atlas, the flat regs between the Saharan Atlas and the Ergs, and the massifs in the eastern part of the country (De Smet, 1991). In Tunisia it occupied the entire Dorsale and the pre-Saharan massifs (Sclater & Thomas, 1898; De Smet 1989, 1991; Kowalski & Rzebik-Kowalska, 1991; Loggers, 1992; Kacem *et al.*, 1994; Cuzin, 1996). Erlanger (1997), in his account of hunting safaris of 1896 and 1897, reported its presence in the massifs south of the chotts. De Beaux (1928) notes the discovery of a Cuvier's Gazelle horn in Al Jaghbub, in the east of Libya, specifying that its source was unknown. It is the only mention of the species for the country; its occurrence in Libya is not otherwise confirmed.





in P.L. Sclater & Thomas. 1897. *The book of Antelopes.*

2.2.2. Decline of the range.

In Morocco, the range of *Gazella cuvieri*, which covered the whole of the mountain chains and associated plateaux, diminished considerably during the 20th century: in the 1930's (or possibly later), it disappeared from the lower Seguia El Hamra, in the 1960's, from the region of Rabat and Casablanca, from several localities in the Middle Atlas at the same time (Cuzin, 1996).

In Algeria, it occupied the slopes of the Tellian chains, those of the more southern massif formed by the Saharan Atlas, and the massifs in the eastern part of the country (Tristam, 1860; Loche, 1867; Pease, 1896; Joleaud, 1929; Heim de Balsac, 1936). It disappeared from a large part of the Tellian Atlas to the east of Teniet el Had, but it was still noted in a few areas of the Mediterranean coast until about 1930 (Joleaud, 1926; Lavauden, 1929; Seurat, 1930).

In Tunisia, where it occupied the area from the Ridge to the region of Tunis, and the pre-Saharan massifs, it was still fairly abundant in 1936 in the entire Tunisian Ridge from the Algerian border to the Djebel Bou Kornine 17 kilometers south of Tunis (Kacem *et al.*, 1994). The species no longer survived in the 1970's except in the vicinity of the Djebels Chambi and Khchem El Kelb between Kasserine and the Algerian border (Kacem *et al.*, 1994); in Dghoumes National Park east of Tozeur, it survived until 1992 (A.Chetoui, head of nat.park, pers.comm.).

2.2.3. Residual distribution.

If until the recent past, the general distribution of Cuvier's Gazelle had not changed much in relation to its historical range, the species is now in sharp geographical decline in Morocco. In most of its range (Eastern Morocco, High, Middle and Saharan Atlas), populations seem to be highly fragmented. Recent discoveries, confirming older data, made it possible to localise substantial populations in Western Anti Atlas and further in the South, in North-western Sahara, with an extension of known range towards the south between the lower Drâa and the Aydar massif (Aulagnier *et al.*, 2001; Cuzin, 1996, 2003).

In Algeria, the range of distribution of Cuvier's Gazelle is limited to the northern part of the country: it is not found anymore in the north of the Tellian Atlas. The species has only recently disappeared from a few localities and these are mainly in the north of its range of distribution. The populations of the western Tellian Atlas, Batna-Biskra, and the Aurès mountains are no longer contiguous, and some groups of the Saharan Atlas were recently eliminated (De Smet & Mallon, 2001).

In Tunisia, after having reached very low numbers, the population currently seems to be increasing and is spreading out again (Kacem *et al.*, 1994), essentially as a consequence of the efficient conservation measures implemented in and around Chambi National Park. For the Ridge in general, observations made in 1991 in the region of Siliana indicate that it is progressing towards the northeast, mainly from the principal population core in the surroundings of the Chambi National Park.

2.2.4. Recolonisation prospects.

This species is mobile and can rapidly recolonise sites occupied in the past insofar as passages remain possible, in particular if calm zones with waterholes exist between the sites. The Tunisian project of fixation of the species and natural recolonisation has had good results, and the Tunisian Government proposes continuing the implementation of a network of protected areas in which management measures similar to those applied in the Khchem el Kelb Reserve will be taken to encourage the redeployment of Cuvier's Gazelle along the full length of the Dorsale. In Morocco, the recent localisation of substantial populations in the south between the lower Drâa and the Aydar massif opens up new, interesting prospects for the conservation of the species.

2.3. Evaluation and evolution of populations.

Current numbers

Estimated numbers : 1450-2450 (Morocco: 600-1500; Algeria: 560 ; Tunisia: 300-400).

In **Morocco**, the total population is currently estimated at between 600 and 1500 individuals including a population of



several hundred individuals recently rediscovered in the lower Drâa (Aulagnier *et al.*, 2001, Cuzin, 1996, 2003). The main populations are in the Western Anti Atlas (population increasing) and in the Lower Drâa-Aydar area (population decreasing), but small groups are spread on the Southern slopes of the High Atlas, in the Eastern High Atlas, in the Saharan Atlas, in the Central and Eastern Anti Atlas, and on the Southern slopes of Middle Atlas (Cuzin, 1996, 2003; Caron *et al.*, 2004).

In **Algeria**, a study of the distribution and numbers of the species carried out at the end of the 1980's estimated the population at 445 individuals (Sellami *et al.*, 1990); De Smet in 1987 estimated the population at minimum 400 individuals and perhaps 500 (De Smet, 1987); in 1991 his estimates were of 560 individuals of which 235 in the Tellian Atlas (sites 1 to 5 in the table below), 140 in the Saharan Atlas (sites 6 to 12, 14 and 15), 135 in the east (sites 16 to 19), and 50 in the central group of the Mergueb (site 13) (De Smet, 1991); the table summarizing the distribution and numbers of *Gazella cuvieri* is taken from De Smet (1991):

1 Sidi Bel Abbes-Tlemcen-Telagh	50 individuals
2 Saida	20
3 Mascara	20
4a Tjaret Frenda	100
4b Djebel Nador	30
5 Ouarsenis Mountain	15
6 El Bayad - Brezina	10
7 Aflou-Laghout	10
8 Ain Sefra-El Abiod Sidi Cheik	10
9 Bechar-Taghit	20
10 Djebel Senalba (Djelfa)	30
11 Djebel Sahari Hunting Reserve	20
12 Guelt es Stel	10
13 Mergueb Nature Reserve	50
14 Bou Saada	20
15 Djebel Bou Kahil	10
16 South Aurès (including Beni Imloul and Barika)	30
17 East of Biskra	15
18 Némentcha Mounts	10
19 Forests of Tebessa	80
Total	560

In **Tunisia**, the number of Cuvier's Gazelles is not known with precision; currently, the main population in the region of Chambi National Park is estimated at 300 individuals (Kacem *et al.*, 1994), and the total population is at least a little higher. The species is found, in fact, in 13 hunting reserves and massifs, listed below (Kacem *et al.*, 1994):

1 Djebel Khchem el Kelb	2900 ha (Faunal Reserves 300 ha)
2 Dj. Serraguia	3000
3 Dj. Gaubeul	3000
4 Dj. Tamesmida	5000
5 Dj. Dernaia	16000
6 Dj. Chambi	10000 (National Parks 6723 ha)
7 Dj. Semmama	12000
8 Dj. Seloum	8000
9 Dj. Es Sif	10000
10 Dj. Hamra	3500
11 Dj. Bireno	3000
12 Ain Bou Driss 1 st Series	3000
13 Oum Djeddour	3000
Total	82400 ha

There is no precise figure on the former numbers of Cuvier's Gazelle, but it was reputed to be common and locally abundant (e.a. Heim de Balsac, 1936). Harper (1945) cites Cabrera who mentioned it in 1932 as particularly numerous in the central part of the Middle Atlas, the territories of Beni Mguild and Ait Aiach, and the length of the contact line between this chain and the High Atlas. Also in 1932, Carpentier notes that it was formerly abundant in the Zaian district near Sidi Lamine and Khenifra (central Morocco).

2.4. Migration.

Joleaud (1929) mentions erratic movements and a somewhat nomadic life. On the Southern slopes of the High Atlas, animals are able to climb towards high altitude (up to 2.600m) in summer. In the High and Anti Atlas, gazelles were often present in pastures where cattle were not allowed; in the Souss plains, after the opening of a pasture to cattle, gazelles settled at a distance of 18 km (Cuzin 2003). In Northern Sahara, animals coming from the Aydar are moving in winter as far as the High Sequia El Hamra, where they are absent in summer (Cuzin 2003), and, in the Lower Drâa, animals are absent in dry pastures, and come back within a few weeks after a rainfall (Cuzin, pers. obs.).



3. CONSERVATION STATUS, BY PARTY

IUCN : RedList of Threatened Species 2004 : EN C2a

Morocco: endangered

The state of conservation of the species in Morocco was described recently by Cuzin (1996, 2003), on the basis of data found in Loggers *et al.* (1992), completed by new data gathered by the Water and Forest Service, by his personal observations, and by the observations of resident and visiting naturalists; it is primarily these recent data which are used here. The species is probably extinct in north-eastern Morocco since 1985. Its range has been greatly reduced in the Ida massif or Tanane, north of Agadir. The species was recently discovered on the southern gradient of the eastern Middle Atlas, towards Outat Oulad El Haj, as well as on hills of the High Plateaux, slightly more to the east (Cuzin, 1996, 2003; Caron *et al.*, 2004). Some small groups have also been observed on the southern gradient of the central and eastern



High Atlas, from the region of Ouarzazate to that of Rich, reaching an altitude of 2600 meters south of Imilchil, where the species is clearly transhumant: numerous testimonies indicate the presence of the species in summer, and its absence in winter (Cuzin, 1996, 2003). Outside of the Middle and Great Atlas, Cuvier's Gazelle was recently observed at the western extremity of the Saharan Atlas in the region of Djebel Grouz (Caron *et al.*, 2004).

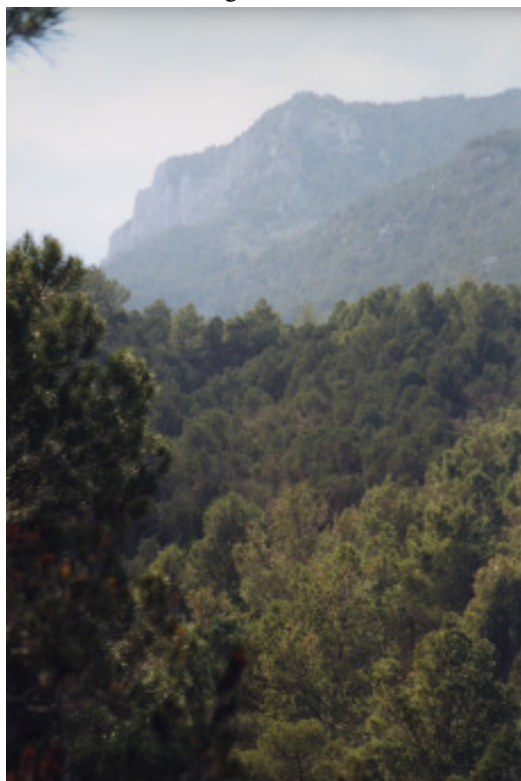
Further towards the Sahara, recent discoveries indicate substantial populations in the western Anti Atlas and the northwestern Sahara, with an extension of known range towards the south between the lower Drâa and the Aydar massif (Cuzin, 1996, 2003). A group of three animals was observed south of Foug Zguid, in 1994. In 1995, the species was found in the entire region situated from the Drâa Wadi, at about a hundred kilometres upstream from its mouth, to the last relief north-east of Smara in the Aydar. This confirmed older data (Morales Agacino, 1949; Aulagnier & Thévenot, 1986) and pushed the southern limit of known distribution southwards by about sixty kilometres (Cuzin, 1996).

Algeria: endangered

The state of conservation of the species in Algeria was recently described by De Smet (1989, 1991) and De Smet *et al.*, (in press), and it is mainly these recent data which are used here. In the northwest of the country, Cuvier's Gazelle is much more widespread than what was thought. Almost all the large national forests of Aleppo Pines (*Pinus halepensis*) shelter small populations and there are contact zones between the majority of these populations. It is also relatively common in the hills between Mascara, Relzane, Tiaret, and Frenda, living there in open countryside with a mosaic of grain crops, vineyards, and pasture lands at the top of the hills. In the Saharan Atlas, most of the summits which are higher and less disturbed still harbour small groups of Cuvier's Gazelle, the most substantial one of these being near Djelfa (Khirreddine, 1977). The most recent information indicates that some of these populations are growing. The most eastern populations are found in the Aurès, the Némentcha mounts, and the hills near the Tunisian border. Near Tebessa there is a concentration of Cuvier's Gazelles, which move to and from the Chambi National Park in Tunisia; further south, they also cross the border back and forth in the Tamerza region.

Tunisia: endangered

In the 19th century, Cuvier's Gazelle was present in all the Tunisian mountains, especially in the high chains of the Ridge in the region of Kasserine, in the northern chains of the Ridge near Ghardimaou, Tunis, and Zaghouan, and in the southern pre-Saharan chains around Gafsa and Tamerza. Its range of distribution had considerably decreased until the 1970's, before the Forest Office took energetic measures, and the numbers had fallen very low. Important measures of habitat management for Cuvier's Gazelle, combined with measures to protect the species, have recently enabled the Tunisian Forest Office to greatly improve the state of conservation of Cuvier's Gazelle; the objectives of the Tunisian program aim to naturally recolonize the historical range of distribution.



Chaambi National Park. Tunisia. © R. Beudels-Jamar-IRScNB

4. ACTUAL AND POTENTIAL THREATS

The species has declined over its entire range owing to the increase in human pressure, essentially in the form of direct taking, but also because of the transformation of wooded zones into pastures and cropland.

4.1. Degradation and decline of habitats.

The degradation and decline of habitats is mainly due to the continuous expansion of pastureland for livestock and the deforestation for agriculture or charcoal. As a consequence, the numbers have been severely reduced and the range fragmented. This cause was identified, at least in Morocco, as the main threat at the present time (Aulagnier and Thévenot, 1986). The vast majority of natural forests have now been destroyed and it is not sure that Cuvier's Gazelle can adapt to plantations of rapid-growth pines. *Gazella cuvieri* seems less tolerant of disturbance than *Gazella dorcas*. Tolerance to disturbance seems very variable. In areas inhabited, Cuvier's Gazelle can tolerate the proximity of humans, and seems capable of surviving in areas less than 2 kilometers from small villages, and regularly cross important local roads. In desertic areas, the gazelles will disappear even in presence of temporary settlements. However, even in inhabited areas, Cuvier's gazelles prefer unused or forbidden pastures where food is abundant and disturbance reduced (Cuzin 2003).

4.2. Direct exploitation.

Excessive hunting and taking have strongly contributed to the decline of Cuvier's Gazelle. Even though its preferred habitat ensures a better protection against hunters in vehicles than that of other species of North African gazelles (De Smet *et al.*, in press), the species is still subject, at least locally, to high poaching pressure. Its populations have thus been reduced, in places, to a few dispersed groups.

4.3. Predation by dogs.

In inhabited area, Cuvier's Gazelle reproduction is rare. Young predation by dogs are at least very possible (Cuzin 2003).

5. REGULATORY PROVISIONS

5.1. International.

Bonn Convention :
Appendix I, Resolution 3. 2, paragraph 4.
Washington Convention (CITES):
Appendix I

5.2. National.

Completely protected
in Algeria, Tunisia,
and Morocco



6. CONSERVATION MEASURES, BY PARTY

6.1. Ban on taking.

The species is protected legally and may no longer be hunted, in Morocco since 1958, in Tunisia since 1966 and in Algeria since 1975.

6.2. Habitat conservation.

Morocco: small populations are currently preserved, especially in the Outat el Haj Royal Hunting Reserve (15) and in the forestry reserve at Tafingoult (60), but in the last one, conceived for Argan tree regeneration, cattle grazing is authorized and gazelles are not present anymore. A large population, probably the largest population in the country, numbering several hundred animals, survives in pre-Saharan regions (Cuzin, 1996); a proposal currently exists to create a protected area in this region, i.e. in the basin of the lower Drâa (Müller, 1996). The creation of such a protected area would open up invaluable conservation prospects for the persistence of the species in Morocco.

Algeria : the species is found in the following protected areas: the Saharan Atlas National Park (20,000 ha; 100 gazelles), Belezma National Park (26,500 ha; number unknown), Nature Reserve of the State of Mergueb (32,000 ha; 50 gazelles), and the National Forest of the State of Djebel Senalba (20,000 ha; 30 gazelles). Small numbers of Cuvier's Gazelle also exist in three hunting reserves: the Djebel Achch Hunting Reserve (400 ha), Djebel Nadour Hunting Reserve (200 ha), and the Djebel Aissa Hunting Reserve (500 ha).

Tunisia: since 1974, the regions frequented by the Mountain Gazelle have been designated as hunting reserves, and in 1980 Chambi National Park (6723 ha) was established. Recent observations indicate that Cuvier's Gazelle is moving back again towards the northeast in the massifs of the Tunisian Dorsale. Active management measures in the Djebel Khchem el Kelb Reserve were put into place as of 1975; the installations include fence laying on three sides of the reserve, the creation of permanent waterholes, fire trenches, provision of salt stones, additional food, and plantations of unarmed *Opuntia* cactus (rich in water and calcium). This measure is to be handled with caution, as this is an introduced species which can behave in a seriously invasive manner.

6.3. Attenuation of obstacles for migratory animals:

not relevant

6.4. Regulations concerning other detrimental factors.

It does not seem necessary to consider other special regulations for Cuvier's Gazelle in Morocco, Algeria, or Tunisia.

6.5. Other measures.

The Almeria Park, in Spain, shelters a collection of animals which reproduce in captivity. The Rabat Zoo also has captive animals.

Animals originating from Djebel Chambi were introduced into Libya (Smith, 1998), but the results of this introduction are not known.

7. RESEARCH ACTIVITIES

7.1. Public authorities.

Special attention should be devoted to the identification of bottlenecks likely to prevent or impede the dispersal and reinstallation of Cuvier's Gazelle populations, in particular in the Tunisian Dorsale, but also elsewhere in the range of the species.

7.2. N.G.O.s

8. NEEDS AND RECOMMENDED MEASURES

Recommended measures are detailed in ASS-CMS Action Plans (Beudels *et al.*, 1998). The principal needs that they meet are listed below.

8.1. Total protection of the species.

Cuvier's Gazelle is included in Class A of the African Convention. Consequently, it can only be hunted or collected with the authorisation of the highest competent authorities and only in the interest of the nation or for scientific reasons. Tunisia and Morocco have ratified the African Convention while Algeria has signed it but still not ratified it.

8.2. Conservation measures.

The principal need is to ensure adequate protection, in particular by the creation of a dense network of reserves allowing the species to disperse and re-extend its range. The development of other hunting reserves, on the basis of the model of Khchem El Kelb in Tunisia, should thus enable other sites to effectively play their relay role, especially between Chambi and Bou Kornine National Parks in the Tunisian Dorsale, as well as elsewhere in the range of the species.

8.3. Localisation and monitoring of residual populations, and definition of their ecological requirements.

It seems that on the whole these populations are well-known and relatively well monitored, and this measure does not seem to be a first priority at the present time. The newly rediscovered population in the lower Drâa in Morocco deserves, however, a very special effort of censusing and protection.

8.4. Reinforcement of populations and reintroduction into the potential range.

Reinforcement of populations by individuals born in captivity has been proposed as a measure aimed at accelerating the redeployment of the species in its former range (Kacem *et al.*, 1994), for instance at Belezma National Park and Teniel el Had National Park in Algeria, or at Bou Kornine National Park in Tunisia. Such measures contribute to the overall protection strategy for the species only to the extent that the connections between the sites are ensured and permanently secured.

¹ Means and Standard deviations



Gazella cuvieri. Habitat. Chaambi NP. Tunisia. © R. Beudels-Jamar - IRScNB



Gazella cuvieri. Enclosure. Bou Kornine National Parc Tunisia. © R.C. Beudels-Jamar - IRScNB



Tunisian Dorsale. One of the best known habitat of Cuvier's Gazelle. Djebel Zagouhan. © R.C. Beudels-Jamar - IRScNB





© *Ouadi Rimé-Ouadi Achim Faunal Reserve, Chad, 1999. François Lamarque*



Gazelles dorcas and Oryx with calf. me tribut. Murals. Ukht-Hop tomb. Egypt. 2000 to 1780 BC

Drawing : Gazella dorcas. J.Smit in Sclater & Thomas, 1899



Gazella dorcas

1. TAXONOMY AND NOMENCLATURE



Gazella dorcas. © Mar Cano. EEZA.

1.1. Taxonomy.

Gazella dorcas belongs to the tribe Antilopini, sub-family Antilopinae, family Bovidae, which comprises about twenty species in genera *Gazella*, *Antilope*, *Procapra*, *Antidorcas*, *Litocranius* and *Ammodorcas* (O'Reagan, 1984; Corbet and Hill, 1986; Groves, 1988). Genus *Gazella* comprises one extinct species, and 10 to 15 surviving species, usually divided into three sub-genera, *Nanger*, *Gazella*, and *Trachelocele* (Corbet, 1978; O'Reagan, 1984; Corbet and Hill, 1986; Groves, 1988). *Gazella dorcas* belongs to sub-genus *Gazella* (Groves, 1969; O'Regan, 1984; Corbet and Hill, 1986) and to its central group (Groves, 1988), within which species limits are not entirely clarified. Groves (1988) distinguishes seven species, *Gazella dorcas* of North Africa, northern Somalia and Ethiopia, the Sinai and southern Israel, *Gazella saudiya* of Saudi Arabia, Kuwait and southern Iraq, *Gazella gazella* of the Arabian peninsula, Israel and Lebanon, *Gazella bilkis* of northern Yemen, *Gazella arabica* of Farasan Island in the Red Sea, *Gazella spekei* of Somalia and eastern Ethiopia, *Gazella bennetti* of Iran, Pakistan and India. *Gazella dorcas* is polytypic and comprises, in Africa, besides *Gazella dorcas pelzelni* of the Somalian region, about four Sahelo-Saharan subspecies, *Gazella dorcas dorcas* in the Western Desert of Egypt, *Gazella dorcas isabella* (*G. d. littoralis*) in the Eastern Desert and the hills of the Red Sea, *Gazella dorcas massaesyala* on the Moroccan high plateaux and in the Atlantic Sahara and its fringes, *Gazella dorcas osiris* (*G. d. neglecta*) in the Sahel, the central Saharan massifs and the northern fringes of the western Sahara (Groves, 1969, 1988; Osborn and Helmy, 1980; Alados, 1988). Possible isolation of these forms does not seem entirely docu-

mented and they do not seem to present clear-cut ecological differences congruent with the taxonomic divergences. Moreover, recent genetic analysis tend to show that there is only a single sub-species in the whole southern Saharan region, from the Atlantic coast to the Nile, this homogeneous population being probably partially isolated from the northern Saharan populations.

1.2. Nomenclature.

1.2.1. Scientific name.

Gazella dorcas (Linnaeus, 1788)

1.2.2. Synonyms.

Capra dorcas, *Antilope kevella*, *Antilope corinna*, *Antilope dorcas*, *Gazella lisabella*, *Gazella littoralis*

1.2.3. Common names.

English: Dorcas Gazelle

French: Gazelle dorcas, Gazelle dorcade

German: Dorkasgazelle

Arabic: Ghazel, Rhazal, Afri

Tamashek: Ahenkod

Toubou: Oueden

1.2.4. Description

A small gazelle with a very pale fawn coloured coat and white underside bordered with a brown stripe, above which there is a sandy stripe. Forehead and face are darker than the body. Well marked dark lines from eye to nostril; between those two lines, a white stripe extends from upper lip to horn base.

Horns are present in both sexes, male's horns being longer and thicker. Horns are lyre shaped, strongly curved, which bow outwards then turn inwards and forwards at the tips; they may have up to 25 annular rings.

TL:	90 - 110 cm
T:	15 - 20 cm
H:	55 - 65 cm
Weight:	15 – 20 kg
Horns :	25- 38 cm

2. BIOLOGICAL DATA

2.1. General Biology.

2.1.1. Habitat

The Dorcas Gazelle is a species of arid and sub-arid zones. It is the most ubiquitous of all the Sahelo-Saharan Antelopes. Habitats in which *Gazella dorcas* has been observed include regs, dunes, flat gravel-plains, mixed gravel and dune areas and gravel plateaux, wadis and rocky areas. It can be found throughout the Sahara and the Sahel, but it tends to avoid very sandy areas or true deserts such as the Majabat al Koubra (Lavauden, 1926c; Dupuy, 1967; Osborn and Helmy, 1980; Kacem *et al.*, 1994). It occurs from coastal plains and desert depressions (Osborn and Helmy, 1980) to 2.000m elevations in the Hoggar Mountains (Dupuy, 1967). Higher elevations, as well as interiors of deserts, are apparently avoided (Grettenberger, 1987).

Important dry season food items include *Acacia spp.*, *Maerua crassifolia*, *Nitraria retusa*, *Citrullus colocynthis* (= *vulgaris*), *Chrozophora brocchiana*, *Leptadenia pyrotechnica*, *Zizyphus spp.*, *Balanites aegyptiaca*, (Carlisle and Ghobrial, 1968; Osborn and Helmy, 1980; Newby, 1974; Grettenberger, 1987; Anon., 1987f). During the wet season, perennial grasses and forbs, such as *Panicum turgidum*, *Tribulus spp.* and *Stipagrostis spp.*, are heavily utilized (Grettenberger, 1987). During dry periods, in southern Morocco, plant species most sought after include *Maerua crassifolia*, *Acacia raddiana*, *Nitraria retusa*, *Argania spinosa* and *Antirrhinum ramosissimum* (Cuzin, 1998). North of the Atlas chain, Dorcas Gazelles mostly feed on herbaceous plants in the wet season, but turn to browsing in the dryer months, in particular on *Zizyphus lotus* (Loggers, 1991)

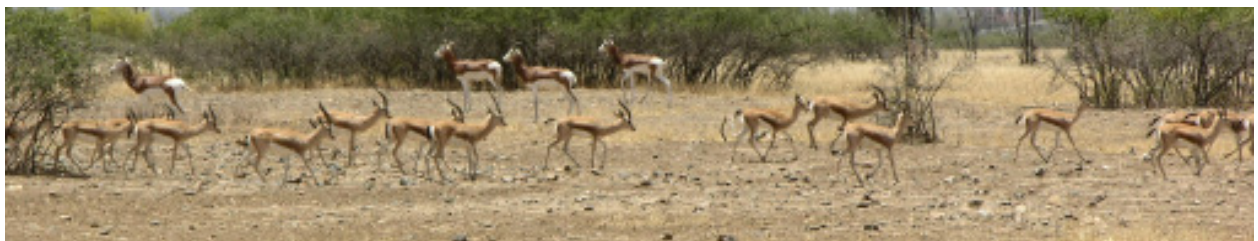
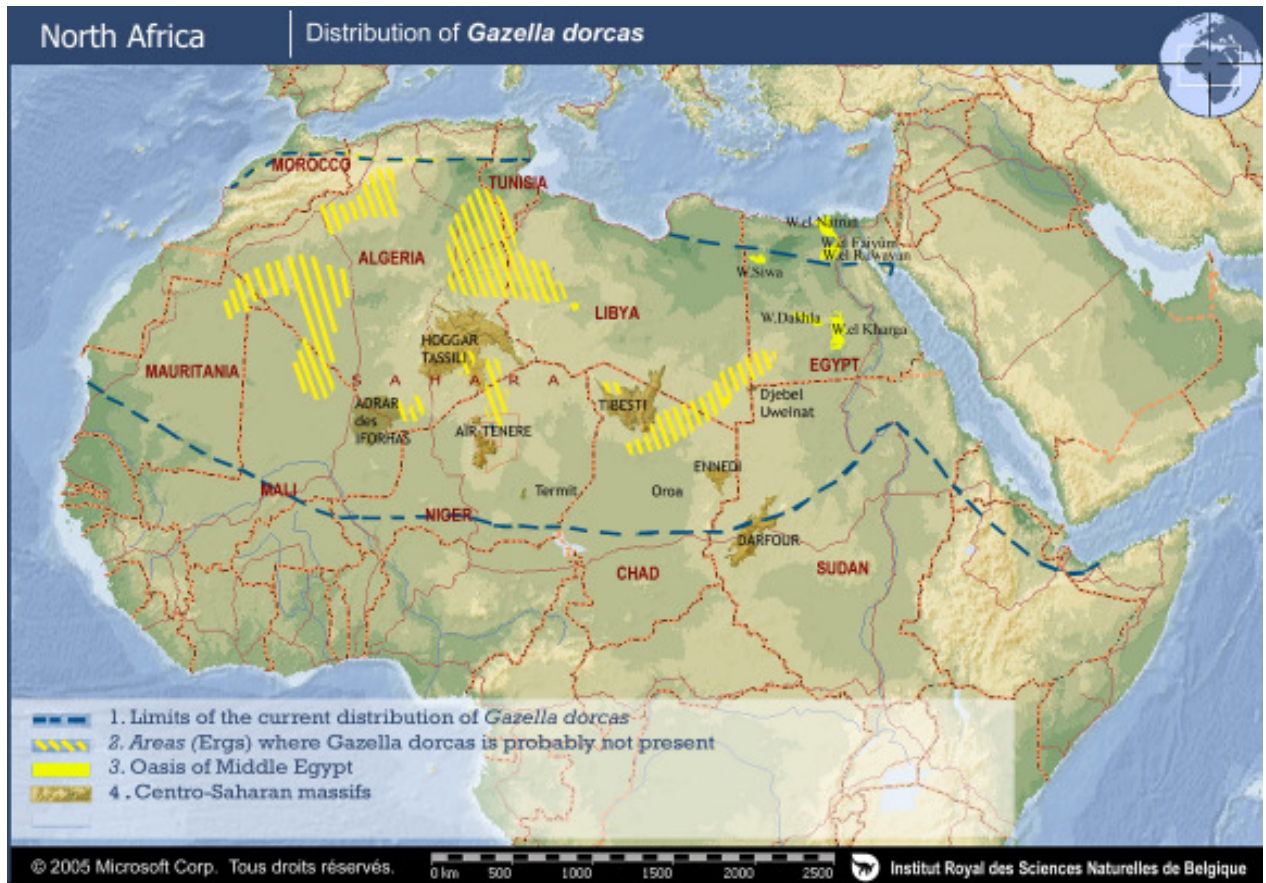
Use of wooded riparian habitats reportedly is high during the dry season, whereas use of more open habitats, such as flat gravel-plains and outwash steppes, is relatively high during the wet season (Newby, 1974; Grettenberger, 1987).

2.1.2. Adaptation

Dorcas Gazelles are able to withstand high temperatures, but when it is very hot they are active mainly at dawn, dusk and during the night. In areas where they face persecution, they tend to be active only at night in order to minimise the risk of hunting.

Like other Sahelo-Saharan antelopes, Dorcas Gazelle does not need free water (Kowalski and Rzebik-Kowalska, 1991) and is capable of satisfying its water requirements by selecting plant foods with high water content (Osborn and Helmy, 1980). It is a flexible browser and a grazer and emphasizes either feeding strategy depending on habitat conditions and the availability of food. For example, in the Aïr-Ténéré reserve in Niger, during a relatively dry period, Dorcas Gazelles primarily browsed, apparently due to a lack of grasses and leguminous plants, whereas in Chad, where these foods were available, it primarily grazed (Newby, 1981). Food habits in these two areas nonetheless overlapped substantially.





Group of Dorcas Gazelles and Dama Mohor (back).
 R'Mila Reserve. Morocco. 2004 © Mar Cano - EEZA



Dorcas Gazelles.
 Jbilet. Morocco. 2004
 © Mar Cano - EEZA

2.1.3. Social Behaviour

When conditions are harsh, dorcas gazelles live in pairs, but when conditions are more favourable they occur in family herds with one adult male, several females and young. During the breeding season, adult males tend to be territorial, and mark their range with dung middens. In most parts of the range, mating takes place from September to November.

Gestation takes six months; a single fawn is the norm, although twins have been reported in Algeria. The newborn is well developed at birth, with fur and open eyes. Within the first hour, the fawn attempts to stand, and it will suckle on this first day of life. In the first two weeks, the young gazelle lies curled up in a scrape on the ground or beneath bushes while the mother grazes close by. The young then starts to follow its mother around and begins to take solid food. After around three months, the fawn stops suckling and is fully weaned, at which time the pair rejoins the herd.

2.2. Distribution.

2.2.1. Historical distribution.

Available information indicates that Dorcas Gazelle historically occurred throughout the Sahelo-Saharan region, from the Atlantic Ocean to the Red Sea and from the Mediterranean coast to the southern Sahel. Its distribution across this area appears to have been relatively uniform, with the exception of hyper-arid deserts and the upper elevations of the central-Saharan massifs. Literature on the species from the 19th and early 20th centuries typically described it as common and locally abundant (e.g., Whitaker, 1896; Lavauden, 1926b; Joleaud, 1929).

2.2.2. Decline of the range.

The distribution of *Gazella dorcas* has been slowly declining, by fragmentation, in northern Africa since the late 1800s. By the mid-1900s, it had largely disappeared from the Atlas Mountains and Mediterranean coastal areas, but southward as far as the Sahel, it remained relatively well distributed. During the 1950s, 1960s, and 1970s, motorized hunting and, to a lesser extent, degradation and loss of habitat, severely impacted the species throughout its range, and although its overall distribution remained intact, its numbers had been greatly reduced (Dupuy, 1967), probably by half (Dragesco-Joffé, 1993), and it had been eliminated from large areas of its range, particularly those accessible to motorized vehicles. In the late 1980s, *Gazella dorcas* still occurred in all the Sahelo-Saharan Range States except Senegal, but its numbers had been substantially reduced, and it was considered threatened or endangered throughout the region with the exception of Niger and Chad, where relatively well protected populations occurred in the Air-Ténéré and Wadi Rimé-Wadi Achim reserves, respectively (East, 1988, 1990, 1992).

2.2.3. Residual distribution.

The most recent information is that Dorcas Gazelle still naturally occurs in all the Range States, except Senegal; however, with the exception of Algeria and Mali, where the distribution and abundance of gazelles may be increasing due to civil war (K. De Smet, *pers. comm.*, January 1997; East, 1997), and Ethiopia, where several hundred occur in protected areas, *Gazella dorcas* continues to be threatened by illegal hunting and, to a lesser extent, loss of habitat due to livestock overgrazing, and its numbers are declining. About a hundred reportedly still occur in the Air-Ténéré National Nature Reserve in Niger (Poilecot, 1996). In Morocco, numbers are estimated at 500-1500; about half of which occur in protected areas; an important population of possibly several hundred animals occurs in the Adrar Soutouf in southern Western Sahara (F. Cuzin, *comm. pers.*, May 2003). According to recent surveys, a population of 1000-2000 is in rapid decline in Egypt (Saleh, *in press*). Numbers in Mali are estimated at 2000-2500 (East, 1997), the area with the highest density is the North Tamesna (Lamarque, *comm. pers.* 2005). It still occurs in the Wadi Rimé-Wadi Achim reserve, but numbers are much reduced (East, 1996a). There are no recent estimates of total numbers of *Gazella dorcas* in Mauritania (B. Lamarche, *in litt.*, October 1996; O. Hamerlynck, *in litt.*, July 1996) or Tunisia (K. De Smet, *pers. comm.*, January 1997). Its status is not known in Burkina Faso or Nigeria. The species qualify for vulnerable status (Hilton-Taylor 2002).

2.3. Evolution and estimation of populations.

Formerly common in its entire range, *Gazella dorcas* has entirely disappeared from many regions and been gravely reduced in numbers where it subsists.





Small groups of dorcas still inhabit Hoggar NP. Algeria.
© Marie-Odile. Beudels IRScNB



Young dorcas. Enclosure. El Bayad. Algeria. 2000.
© Amina Fellou-ANN Algeria



Gazella dorcas.
South-Tamesna. Mali 2004.
© Stéphane Bouju

2.4. Migration.

Dorcas Gazelle are nomadic and exhibit relatively small-scale seasonal movements in response to the availability of pasture (Heim de Balsac, 1936; Newby, 1974), sometimes of a trans-border character, but within the same geographical region.

3. CONSERVATION STATUS, BY PARTY

IUCN : RedList of Threatened Species 2004 : VU A1a

Morocco : endangered (Cuzin, 1996 and 2003).

With the possible exception of the high elevation of the Atlas Mountains, Dorcas Gazelle was historically distributed throughout Morocco and Western Sahara (Aulagnier, 1992). In the 1800s, it reportedly occurred west of the Atlas Mountains at low densities and remained uniformly distributed and abundant elsewhere. By the 1950s, the species had disappeared west of the Atlas, except for one population in the vicinity of Safi, and had been reduced to low numbers on the northern, eastern and southern flanks of the Atlas; at the time, it also had become rare along the coast in the Western Sahara nearly to Dakhla (Aulagnier, 1992). In the early 1990s, the extent of the species' range had not changed, but it had been reduced to small widely dispersed groups east and south of the Atlas and throughout the Western Sahara (Aulagnier, 1992; Loggers *et al.*, 1992). Nowadays, the only remaining population in the North-West of the Atlas chains is the small population of the M'Sabih Talaa Reserve, near Chichaoua. The species disappeared from the Souss plains in 1987, from the Noun region in 1996, and the only remaining individuals in the plains between Ouarzazate and Tafilalet survive in the enclosures of the El Kheng Reserve. Elsewhere, the distribution of the species remains the same, but groups have been reduced to small sizes, continuously decreasing in numbers, dispersed to the East and South of the Atlas and throughout Western Sahara (Aulagnier, 1992, Loggers *et al.* 1992, Cuzin 2003) : in the Bas Draa, numbers went from 150 individuals in 1997 (Cuzin 1998) to around forty individuals (F. Cuzin, comm. pers., 2003).

It was recently estimated that a population of approximately 100-200 animals occurs west of the Atlas in the M'Sabih Talaa Reserve, near Chichaoua (Marraha 1996). East of the Atlas it is very rare, typically occurring in widely dispersed populations of 20-50 animals. A population of about 100 occurs at the base of Jebel Gouz and west to Figuig along the Algerian border. Approximately 50 are found in the upper Draa Valley in the vicinity of Zagora; 100-200 remain in the Middle Draa, primarily in the Tata Province, and about 200 occur in the Lower Draa between Assa and Msseyed (F. Cuzin, *in litt.*, May 1996; Aulagnier *et al.*, in press). The remnant population in the Souss Valley has been extirpated (Cuzin, 1996). The total number in Morocco, from the Draa Valley northwards, is estimated at 500-800 (F. Cuzin, *in litt.*, May 1996). Southward through the Western Sahara, the distribution and abundance of the species has been considerably reduced, but several hundred are thought to remain, mostly in the Adrar Soutouf in the far south (F. Cuzin, *in litt.*, May 1996; Aulagnier *et al.*, in press).

Poaching, habitat loss due to overgrazing and permanent agriculture are the primary threats to the species (Aulagnier *et al.*, in press, Cuzin 2003).

Algeria: probably vulnerable.

With the possible exception of the dunes in the southwest (i.e., Erg Chech and Erg d'Igudi), Dorcas Gazelle historically occurred throughout Algeria (Lavauden, 1926; Dupuy, 1967; DeSmet, 1988; Kowalski and Rzebik-Kowalska, 1991). There is some question of the validity of, 19th century reports of the species in the Mediterranean coastal area, because of possible confusion with *Gazella cuvieri* (Kowalski and Rzebik-Kowalska, 1991), but given the species broad occurrence in coastal areas elsewhere in its range, it is likely that the reports are valid.

The distribution of *Gazella dorcas* has gradually retracted southward throughout the 19th and 20th centuries. In the 1920s and 1930s, it remained widely distributed and common on the High Plateau from Morocco to Tunisia, on the plateaux south of the Saharan Atlas, between the Great Eastern and Great Western ergs, and throughout the southeastern portion of the country (Joleaud, 1929; Maydon, 1935).

Its distribution and numbers declined through the mid-1900s, particularly during the 1960s and 1970s due to motorized hunting, but it remained common and locally abundant in many parts of its Algerian range into the 1970s and 1980s (Dupuy, 1966; Anon., 1987f). The northern limits of the species' range continued to move southward, however, and by

the 1980s, it did no longer occurred north of the Saharan Atlas (Kowalski and Rzebik-Kowalska, 1991; De Smet and Mallon, in press).

Dorcas Gazelle presumably remains widely distributed in the Saharan zone of Algeria, but numbers are believed to greatly reduced (De Smet and Mallon, in press). Control of firearms due to military activity in recent years apparently has reduced poaching (De Smet, *pers. comm.*, March 1997) but not enough to stop the decline of the species (De Smet and Mallon, in press). No estimate of numbers in the wild is available.

Tunisia: vulnerable.

Dorcas Gazelle formerly occurred throughout Tunisia, south and east of the Tell Atlas, and north and east of the Great Eastern Erg (Whitaker 1896; Lavauden, 1926b, Joleaud, 1929; De Smet, *pers. comm.*, May 1996). In the early 1900s, the species remained well distributed in the country and was observed in large herds in areas such as the grassland plains bordering the Mehedra plateaux (Lavauden, 1926b, Schomber and Kock, 1961). At that time herds, of 50-80 were not uncommon, and occasionally concentrations of several hundred animals were seen. By the 1920s, however, the species reportedly was in decline. The northern limit of its range was moving southward, and large herds were uncommon (Lavauden, 1920, 1926). In the 1960s, *Gazella dorcas* had largely disappeared from the north. It still occurred north of Chott El Jerid to the Saharan Atlas (Müller, 1966), but it was markedly less numerous in the central than in southern districts, where moderate herds could still be found in sub-desert steppe east of the Great Eastern Erg (Schomber and Kock, 1961).

Dorcas Gazelle is presently limited to the southern half of the country, approximately south of a line between Gafsa and Gabes (i.e., 34° -35° N Latitude) (Smith *et al.*, in press). Specific information on distribution and numbers of the species within this range is largely lacking. Illegal hunting and habitat degradation due to livestock overgrazing continue to be threats.

Libya: endangered.

Limited information from Libya, coupled with reports of the species in bordering areas of Algeria (De Smet, 1988), Tunisia (Lavauden, 1926b), Niger (Grettenberger and Newby, 1990), Sudan (Hillman and Fryxell, 1990), and Egypt (Saleh, 1987), indicate that *Gazella dorcas* was historically distributed throughout the country (Hufnagl, 1972; Essghaier, 1980; Esschaier and Johnson, 1981; Anon., 1987; Khattabi and Mallon, in press).

In the 1960s and 1970s, the species was still widely distributed across the northern and central regions (Essghaier, 1980), and in the southeast, and it remained abundant in a few areas, such as the Hammada El Hamra in the west and Djebil Uwenait in the southeast (Misonne, 1977; Essghaier, 1980). Overall, however, its numbers and distribution were declining rapidly at that time, due to uncontrolled motorised hunting (Hufnagl, 1972).

In the late 1980s, the species still occurred locally in Libya but in greatly reduced numbers (East, 1992). The situation reportedly remains the same (Khattabi and Mallon, in press), however, information on the current distribution and numbers of the species is lacking.

Egypt: vulnerable.

The historical range of *Gazella dorcas* included the northern, central, and eastern parts of Egypt (Saleh, 1987). With the exception of the vicinity of Djebil Uwenait and Gilf Kebir (Osborn and Krombein, 1969), there are no records of the species in the arid west-central and southwestern districts (Osborn and Helmy, 1980; Saleh, in press). Due to human pressure, primarily hunting and trapping, the distribution and abundance of the species declined considerably during the late 1800s and early 1900s, and by the 1920s, it had disappeared from entire districts (Flower, 1932). By the 1960s, *Gazella dorcas* had been eliminated from the immediate vicinity of the Mediterranean coast and semi-desert areas with good pasture; elsewhere herds were small and uncommon (Hoogstraal, 1964).

In the late 1980s, Dorcas Gazelle no longer occurred in the northcentral region of the country from the Suez Canal through the Nile delta and westwards to the Quattara Depression, where important populations historically occurred. It still occurred over most of the remainder (i.e., southern parts) of the country, but populations were widely scattered. The few concentrations that remained were limited to remote, inaccessible areas, and the species was considered in eminent danger of extinction (Saleh, 1987).

Recent information is that Dorcas Gazelle populations continue to decline throughout Egypt, due to uncontrolled hunting; it is estimated that between 1000 and 2000 survive, mostly outside protected areas (Saleh, in press).

Mauritania: endangered.

Trotignon (1975) concluded that Dorcas Gazelle historically was abundant throughout Mauritania, with the exception of the desertic heart of the Majabat Al Koubra in the east, and the southern portion of the Sahel zone in the south. Given the occurrence of the species in northern Senegal (Sournia and Dupuy, 1990) and in Mali adjacent to the southeastern corner of Mauritania (Heringa, 1990), it is very likely that the historical range of Dorcas Gazelle encompassed all of the country.

The species experienced a catastrophic decline during the 1950s and 1960s. In areas where herds numbering in the dozens were once common, only isolated individuals were observed by the early 1970s (Trotignon, 1975). In the late 1970s, Lamarche (1980) reported that it was rare in the Majabat al Koubra. A population in the Banc d'Arguin National Park, which once numbered 200 (Anon., 1987f), declined from approximately 100 to less than 10 between 1970 and 1983 (Verschuren, 1985). In the early 1980s, Dorcas Gazelle was considered threatened (Newby, 1981a), and by the late 1980s, it had been largely extirpated and survived only in small numbers in very remote areas (Sournia and Verschuren, 1990). More recently, a population of ca 40 individuals survived on Tidra, an island situated in southwest of Banc d'Arguin National Park (F. Lamarque, com. pers., 2005).

Dorcas Gazelle has recently been observed in the Maqteir in the northwest, and it probably still occurs in the Areg Chach and Hank Escarpment in the northeast (B. Lamarche and O. Hammerlynck, *in litt.*, April 1997). Information on the status of the species elsewhere, e.g., in the continental part of Banc d'Arguin NP, is unavailable. Illegal hunting is a serious threat to this and other antelope species, and it largely occurs in inaccessible areas. (O. Hammerlynck, *in litt.*, April 1997).

Mali: probably endangered.

Heringa's (1990) range map for Dorcas Gazelle includes all of the Sahel and Sahara zones of Mali, i.e., everything north of about 15°N latitude, which probably represents the overall historical distribution of the species. It apparently never occurred, however, in most arid deserts in the north (Heringa, 1990). This is consistent with the lack of records for the species in adjoining, hyper-arid areas of Algeria (De Smet, 1988). However, records of *Gazella leptoceros*, a desert-loving species, also are lacking from northern Mali and southwestern Algeria, and the absence of records of Dorcas Gazelle (and other antelopes) in this area (Sayer, 1977) may be related to its remoteness.

Gazella dorcas was formerly locally common in Mali (Heringa, 1990). In the 1970s, it still occurred throughout the country, but it was rare and locally extirpated in much of the Sahel zone, and its numbers had been greatly reduced in the northeast (Adrar des Iforas and Tilemsi) (Sayer, 1977). In the early 1980s, its distribution and overall abundance had been further reduced, but it remained locally abundant in a few areas, such as the vicinity of Gao (J.M. Pavy, *in litt.*, September 1996). In the late 1980s, small populations also survived in the Elephant Faunal Reserve and the Ansongo-Manaka Faunal Reserve in the Sahel zone, at the southern extremity of the species' range (Heringa, 1990).

Uncontrolled hunting and severe drought have severely impacted the Dorcas Gazelle population in northern Mali in recent years (East, 1997a). To the south in the sub-desert zone (northern Sahel), the species remains widely distributed in small populations that may total 2000 to 2500 animals (Niagate, 1996; J.M. Pavy, *in litt.*, September 1996). Numbers apparently increased during the rebellion in early 1990s (Niagate, 1996). Information is lacking on the status of remnant populations in the Elephant and Ansongo-Manaka, but recent records of Dorcas are rare. Nowadays, the area with the highest density of Dorcas Gazelle is the Northern part of the Tamesna plain, in the South-West of the Adrar des Iforas. However, Dorcas Gazelles are heavily poached in that easily accessible area which make them particularly vulnerable (Lamarque et Niagaté, 2004). If present population estimates are reasonably accurate, the species undoubtedly is threatened.

Niger: probably vulnerable or endangered.

The historical range of *Gazella dorcas* in Niger likely was not substantially different from that in the 1980s, when the species occurred throughout the country north of approximately the 14th parallel (Grettenberger, 1987; Grettenberger and Newby, 1990). Within this area, it apparently was absent from the high elevations of the Aïr Mountains and the interior of the Ténéré Desert to the northeast.

In the early 1980s, it was estimated that 5000 or more survived within the Aïr Ténéré National Nature Reserve, and several thousands occurred in the Termit area to the southeast (Grettenberger and Newby, 1990). Historically the species probably numbered in the tens of thousands, or more.

Recent estimates of 20000 country-wide (Dragesco-Joffe, 1993) and several thousand in the Aïr Ténéré National Nature



Reserve (Poilecot, 1996) are based on data from 1991 or before, and the present status of the species is unknown. Illegal hunting, habitat degradation, and competition with livestock (Grettenberger and Newby, 1990) probably remain threats.

Chad: probably vulnerable or endangered.

In the late 1970s, Dorcas Gazelle occurred throughout Chad north of 13° 30' N latitude (Newby, 1981a), and this probably represents the species' historical distribution in the country. It reportedly does not occur on the high massifs (Thomassey and Newby, 1988), but elsewhere its former distribution probably was uniform. In the late 1970s, it was estimated that approximately 35000 to 40000 Dorcas Gazelles occurred in the Wadi Rimé Wadi Achim Faunal Reserve, which encompasses possibly a quarter of the species distributional range in Chad (Newby, 1981a). Despite intensive hunting pressure, particularly during the civil war, Dorcas Gazelle remained widely distributed in Chad through the 1980s, when it was estimated that the species numbered in the low tens of thousands (Thomassey and Newby, 1990).

Information on the status of the species since the 1980s is lacking. During the 1990s, the Chadian Direction of National Parks and Faunal Reserves reported that Dorcas Gazelle remains in the Wadi Rimé Wadi Achim Faunal Reserve but in greatly reduced numbers (East, 1996a), and this likely is indicative of the species' status elsewhere in the country. However, recent prospections in the reserve in 2001 showed that Dorcas Gazelles are still abundant in Wadi Rime Wadi Achim Faunal Reserve, this reserve having the highest density for the species for the whole of the Sahel region (Abundance Kilometer Index: 4.3 Dorcas gazelles /km) (Wacher et al. 2001).

Sudan: probably near threatened or vulnerable.

Dorcas Gazelle was formerly well distributed throughout the desert and sub-desert zones of central and northern Sudan, from Chad and Libya to the Red Sea (Hillman and Fryxell, 1988). The southern limits of its range were approximately 14° N latitude in the West and ±16°N latitude in the East. It was probably common and locally abundant throughout this range. *Gazella dorcas* was once particularly abundant in the vicinity of the Nile, from Wadi Halfa at the Egyptian border southward through Dongola and the Bayuda Desert (Hassaballa and Nimir, 1991) and in the vicinity of Wadi Howar in Northern Darfur (Maydon, 1923). It was common in the Red Sea Hills (Maydon, 1935).

Dorcas Gazelle undoubtedly has declined considerably in recent decades due to uncontrolled hunting and degradation/loss of habitat due to livestock overgrazing and agricultural encroachment (Hillman and Fryxell, 1988; East, 1996). The effects of land degradation have been compounded by drought. In the 1930s, *Gazella dorcas* remained well distributed throughout its historical range (Brockelhurst, 1931; Maydon, 1935), but by the 1970s, it had disappeared from most of the northwestern and northeastern parts of the country (Ghobrial, 1974). In the 1980s, it remained widely distributed but in ever-fragmented and greatly reduced populations (Newby, 1981a; Hillman and Fryxell, 1988).

The species still occurs in the deserts of northern Sudan, and unconfirmed information from hunters is that numbers in the region are locally good, and recent surveys have indicated that the species is still common in the Red Sea Hills (I. Hashim *in litt.*, November 1996, December 1996).

Senegal: extinction in the wild; reintroduced in large fences within protected areas.

Poulet's (1972) sighting of Dorcas Gazelle in the Fete-Ole area 100km east of St. Louis is the only record for the species in Senegal. Peul tribesmen in the Ferlo region apparently have no name for the species, and it is likely that it historically occurred in Senegal only as a vagrant (Dupuy, 1984). Newby (1981) considered it rare in the country. In 1972; the Senegalese National Park Service introduced 15 Dorcas Gazelles within Djoudj National Park in the northwest of the Park (Dupuy, 1984). This captive herd grew to approximately 50 by the early 1980s (Dupuy, 1984) but experienced a serious decline during the late 1980s (Sournia and Dupuy, 1990). It reportedly still occurs, but numbers are not known (B. Clark, *in litt.*, September 1996). Cette partie n'est pas dans le texte français!

Burkina Faso: probably endangered.

Gazella dorcas historically occurred in the Sahel zone of northern Burkina Faso, where it still survived in the late 1980s. It was considered endangered at the time, due to poaching and habitat lost, and largely confined to the Seno-Mango area at the northern extremity within the Sahel Partial Faunal Reserve, at the Mali border (Heringa *et al.*, 1990). There was no mention of Dorcas Gazelle in a recent update on antelopes in Burkina Faso (East, 1996a), and its status in the country is unreported. Given the present level of human activity in the Sahel region, illegal hunting and habitat degradation probably remain serious threats to the species.

Nigeria: possibly extinct.

Dorcas Gazelle reportedly is a rare inhabitant of the small area of Sahel in northeastern Nigeria, in the vicinity of Lake Chad (Anadu and Green, 1990). In the late 1980s, its status in the area was unknown, but it very possibly was extinct, due to overhunting hunting and habitat encroachment by livestock (Anadu and Green, 1990).

Ethiopia: lower risk.

The historical range of *Gazella dorcas* included the arid lowlands (steppe, semi-desert, and desert) of northern and eastern Ethiopia from the extreme north of the Eritrea province through the Danakil plains and to the foothills of the Chercher Mountains (Anonymous, 1987f, Hillman, 1988; Yom-Tov *et al.*, 1995; Kingdon, 1997). In the mid-1980s, its numbers were unknown, but presumably stable, and its conservation status was considered satisfactory (Hillman, 1988).

Gazella dorcas was not observed in recent aerial and ground surveys in Yangudi NP, but a population of several thousand is estimated to occur in the adjacent Mille-Serdo reserve and Danakil desert to the north (East, 1997b). No information is available on the status of the species in the northwest, but given estimated numbers and tribal stability in the Mille-Serdo/Danakil area, the species presently appears to be stable and not threatened.

4. ACTUAL AND POTENTIAL THREATS

4.1. Degradation and decline of habitats.

The species has suffered, though to a lesser degree than other sahelo-saharan antelopes, , because of its greater ecological flexibility, from catastrophic droughts, degradation of pastures through overgrazing, cutting of woody plants and loss of optimal habitats to development pressures.

4.2. Direct exploitation.

The decline of *Gazella dorcas* has to be attributed primarily to uncontrolled hunting. Traditional hunting could have had a substantial impact on local populations but it is modern hunting with firearms and motor vehicles (Newby, 1990) which constitutes the primary threat.

4.3. Other threats.

There are no other known threats.

5. REGULATORY PROVISIONS

5.1. International.

Bonn Convention: Appendix I, Resolution 3. 2; paragraph 4.
Washington Convention (CITES): Appendix III (Tunisia).

5.2. National.

Protected or partially protected in Morocco, Algeria, Tunisia, Libya, Egypt, Mali, Sudan, Burkina Faso, Nigeria, Ethiopia, Somalia



Gazella dorcas. North Tamesna. Mali. 2002
Ouadi Rimé-Ouadi Achim Reserve. Chad. 1999
© François Lamarque.

6. CONSERVATION MEASURES, BY PARTY

6.1. Ban on taking.

Algeria:	protected
Tunisia:	protected
Morocco:	protected
Egypt:	protected
Mali:	protected
Ethiopia:	hunnable under license

6.2. Habitat conservation.

Morocco:

Dorcas Gazelle occurs in the M'Sabih Talaa reserve (100-200 ind.), the El Kheng Reserve (15-30 ind.) (Marraha 1996, Aulagnier *et al.*, 2001, Cuzin 2003), and in the recently gazetted reserve in the Lower Draa Valley (40 ind.) (F. Cuzin, pers. comm., 2003), as well as more to the East in the Drâa Valley (50-200 ind.) (Cuzin 2003), and in the far South, south of Dakhla (several hundreds individuals, Aulagnier *et al.* 2001). Small herds may intermittently occupy permanent hunting reserves, but no specific measures for conservation or management of the species are taken in such areas.

Protection of remnant populations in the M'Sabih Talaa, El Kheng and Lower Draa reserves and evaluation of the potential for establishing a protected area in the Adrar Soutouf are priority actions for *Gazella dorcas* in Morocco and Western Sahara (F. Cuzin, *in litt.*, May 1996; Cuzin 2003).

Establishment of a reserve at Jebel Grouz would protect remnant populations in eastern Morocco, and enlargement of El Kheng reserve would help ensure protection of the Tafilalt population (Aulagnier *et al.*, 2001). Restoration of the species in the semi-desert zones of northeastern Morocco, along the Eastern Plateau, may be accomplished by reintroductions and reinforcements in several large hunting reserves that occur in the area (Aulagnier *et al.*, 2001).

Attempt at reintroduction or reinforcement should be preceded by a global genetic analysis of the different national stocks, both wild and semi-captive, in order to ensure the scientific soundness of such projects. (Cuzin 2003).

Algeria:

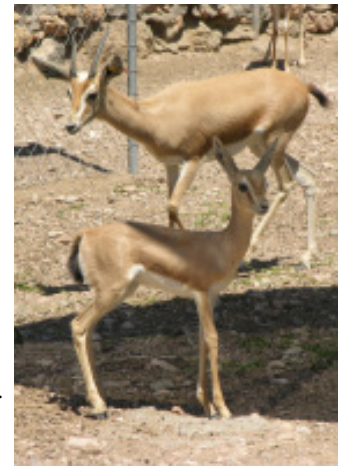
Dorcas Gazelle occurs in large numbers in the Hoggar and Tassili national parks in the south of the country, but receives little protection there.

Gazella dorcas is included in the Algerian Agency for Nature Conservation's proposed captive-breeding programme for Sahelo-Saharan wildlife (B. Kadik, *in litt.*, June 1996). Surveys are needed to determine the distribution and abundance of the species. Establishment of a reserve in the western High Plateau would protect a distinct geographic form of the species (De Smet and Mallon, *in press*).

Tunisia:

Approximately 120-150 Dorcas Gazelle occur in Bou Hedma National Park, near the northern extremity of the species current distribution (H. Lazhar, *pers. comm.*, June, 1997), and approximately 30 are estimated to inhabit Sidi Toui National Park in the southeast (A. Mertah, *pers. comm.*, June 1997). The species also occurs in Djebil National Park on the northeastern edge of the Great Eastern Erg, as well as in several smaller reserves (Anon., 1987; De Smet and Mallon, *in press*), but numbers in these areas are not known. A small faunal reserve, completely fenced (200 ha), the Orbata Reserve, near Gafsa, contains a population of over 180 Dorcas Gazelles: the objective of this reserve is to breed Dorcas Gazelle in Tunisia for reintroduction purposes.

Dorcas Gazelle is among the species identified in the DGF's programme for restoration of wild fauna in Tunisia, but no measures aimed specifically at conservation of the species have been proposed. Illegal hunting is the greatest threat to the species and strict enforcement of hunting laws is essential. The fundamental priority for the species is systematic survey to determine its status in the wild and identify areas with needs and potential for conservation action.



Female and young.
Almeria, Spain
© Mar Cano-EEZA.

Libya:

Approximately 150 Dorcas Gazelles occur in the 1000 km² New Hisha Nature Reserve. In 1991; 15 animals were translocated from Sudan to El-Kouf NP (85km²).

The Libyan Wildlife Technical Committee plans to establish a network of protected areas that will include the southern parts of the country (Khattabi and Mallon, in press). Selection of sites for protection should consider existing needs and potentials for restoration and conservation of Dorcas Gazelle and other antelopes. In the short-term, conservation actions should focus on protection of populations that occur in conservation areas, particularly New Hisha Reserve, and reintroduction of the species into suitable protected areas, such as the Zella Nature Reserve.

Egypt:

Dorcas Gazelle occurs in the Djebel Elba protected area in the southeast and the El Omayed Scientific (Biosphere) Reserve west of Alexandria (Anon., 1987f). Protection in these reserve is very limited, however, and considerable poaching occurs (Saleh, in press).

Stronger enforcement of hunting regulations and effective management of protected areas are conservation priorities for the species. Reintroduction into a planned protected area in northern Sinai has been proposed (Saleh, in press).

Mauritania:

Dorcas Gazelle occurs in Banc d'Arguin National Park. The population suffered tremendous losses in the 1980s due to illegal (Sournia and Verschuren, 1990) but reportedly is currently stable (O. Hammerlynck, *in litt.*, April 1997). No other protected areas are located in the range of the species, and no measures have otherwise been taken for its conservation.

Effective management of Banc d'Arguin NP is a priority for conservation of the species in Mauritania (Sournia and Verschuren, 1990). Establishment of protected areas for restoration of scimitar-horned, oryx, addax, and dama gazelle would benefit the species.

Mali:

Dorcas Gazelle may still occur in low number in the Elephant and Ansongo-Menaka faunal reserves, but these areas are seriously threatened by habitat degradation and hunting (East, 1997). There are no protected areas in the sub-desert and desert zones to the north.

Rehabilitation of the Ansongo-Menaka and Elephant reserves is important for restoration of *Gazella dorcas* in Mali. The latter reserve lies in the Gourma area, which has been identified as an important site for biodiversity conservation (J.M. Pavy, *in litt.*, January 1996) and may be the best opportunity for conservation of the species (East, 1997). The Gourma elephants and biodiversity conservation programme (FFEM/GEF) which is still in its early phases (2005) should contribute to the restoration of the residual Dorcas Gazelle populations. The Adrar des Iforhas and associated plains of Tilemsi and Tamesna, where Dorcas Gazelle still occurs, have been identified in several occasions as priority areas for biodiversity conservation projects (J.M. Pavy, *in litt.*, January 1996). Several areas are currently under process for designation as protected areas in the region (Tamesna Reserve, strict nature reserves of North Azawagh and Ouest Zdjaret); such protected areas, if they materialise, could contribute significantly to Dorcas Gazelle preservation in Eastern Mali (Lamarque, com. pers., 2005).

Niger:

Dorcas Gazelle occurs in the Air Ténéré National Nature Reserve. The Gadabedgi Faunal Reserve formerly harboured a small population (Grettenberger and Newby, 1990), but there is no recent information of the status of the species in this area. Effective management of the Air Ténéré National Nature Reserve and establishment of a protected area in the Termit region are actions that would improve the conservation status of the species.

Chad:

The species occurs in the Wadi Rimé Wadi Achim Faunal Reserve, where control has been regained. It also may occur in the unmanaged Fada Archei reserve in the Ennedi east of the Wadi Rimé Wadi Achim Faunal Reserve (Thomassey and Newby, 1990). Systematic survey of the Wadi Rimé Wadi Achim Faunal Reserve and other areas of Chad for Scimitar-horned Oryx and Addax will provide information on the status of Dorcas Gazelles. This and rehabilitation of the Wadi Rimé Wadi Achim Faunal Reserve are priority actions for conservation of the species.

Sudan:

There are no protected areas within the range of Dorcas Gazelle in Sudan. Survey and protection of remnant populations and habitat in the desert and sub-desert regions of the northwestern section of the country are priority actions for conservation action (I. Hashim, *in litt.*, November 1996). Specifically, planning and development of the proposed Wadi Howar National Park (East, 1996b) would be a major step towards regional restoration and protection of the species.

Senegal:

In 1972, the Senegalese National Park Service introduced 15 Dorcas Gazelles at the Djoudj National Park in the extreme northwest (Dupuy, 1984). This captive herd reportedly still exists, but numbers are not known (B. Clark, *in litt.* September 1996). If Ferlo Faunal Reserve is upgraded to national park status and receives adequate protection, (re)introduction of Dorcas Gazelle into the area could be accomplished in conjunction with planned reintroductions of Scimitar-horned Oryx and Dama Gazelle (B. Clark, *in litt.*, September 1996).

Burkina Faso:

The range of Dorcas Gazelle lies entirely within the Sahel Partial Faunal Reserve, where hunting is restricted (IUCN, 1987). The Seno-Mango area in the north of the Sahel zone was proposed for development of a Biosphere Reserve. Establishment and effective management of this proposed protected area is essential for conservation of the Dorcas Gazelle in Burkina Faso (Heringa *et al.*, 1990). The GEF transborder programme for the Malian Gourma and the Burkinabe Sahel biodiversity conservation and natural resources management, should contribute to the conservation of Dorcas Gazelles residual populations in these areas.

Nigeria:

There are no protected area within the range of Dorcas Gazelle in Nigeria (Anadu and Green, 1990).

Ethiopia:

Dorcas Gazelle occurs (or occurred, Hillman, 1988) in Yangudi Rassa National Park and adjacent Gewane and Mille-Sardo wildlife reserves in the northcentral section of the country.

In the 1980s, priorities for conservation of Dorcas Gazelle and other wildlife were to enhance the capacity of the Ethiopian Wildlife Conservation Agency, through international support, and to develop the existing framework of conservation areas into an effective protected area system (Hillman, 1988). Planning to improve protected area management has begun, but implementation of actions has not (East, 1997b). In the case of Dorcas Gazelle, development of the Mille-Sardo wildlife reserve and Yangudi NP are priorities.

Eritrea:

Dorcas Gazelles are known to occur in Nakfa and Yob wildlife reserves in the northwest (Hillman, 1988). No recent information available on population sizes.

6.3. Attenuation of obstacles for migratory animals.

Only protection within a network of protected areas, especially cross-border protected areas, is plausible.

6.4. Regulations concerning other detrimental factors.

Such regulations can only be taken within a framework of management plans for protected areas. This paragraph consequently merges with paragraph 6.2.

6.5. Other measures.

Morocco:

Captive herds that total more than 500 animals have been established at the Royal farms of Bouznika and Douyiet and, more recently, R'Mila Royal Reserve and Souss-Massa National Park (Aulagnier *et al.*, in press; Bousquet 2002). The latter area is the site of a large-scale captive management programme for Sahelo-Saharan wildlife with the aim of produc-



ing stock for reintroductions elsewhere in the country, primarily proposed reserves in southern Morocco (Lower Draa-Aydar) and the Western Sahara (Adrar Souttouf) (AEFCS 1995 ; H.P. Müller, *in litt.*, December 1996).

Sudan:

Dorcas Gazelle is not protected by law and there are no protected areas within its range in Sudan. It is found in captivity in and around Khartoum, where many wildlife farms exist.

Outside Sahelo-Saharan range:

Dorcas Gazelles in semi-captivity are present in various locations, in particular in the United States, in Spain and in Israel.

7. RESEARCH ACTIVITIES

7.1. Public authorities.

7.2. N.G.O.s

8. NEEDS AND RECOMMENDED MEASURES

Recommended measures are included in an associated Action Plan (Beudels *et al.*, 1998).



Landscape South Tamesna and training under an acacia. Mali. 2005. © François Lamarque-ONCF



*Female & male. Almeria.
Spain. © Mar Cano-EEZA.*

*Female & male in the wild.
© Tim Wacher-ZSL.*



Air-Ténéré. Niger. © John Newby

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