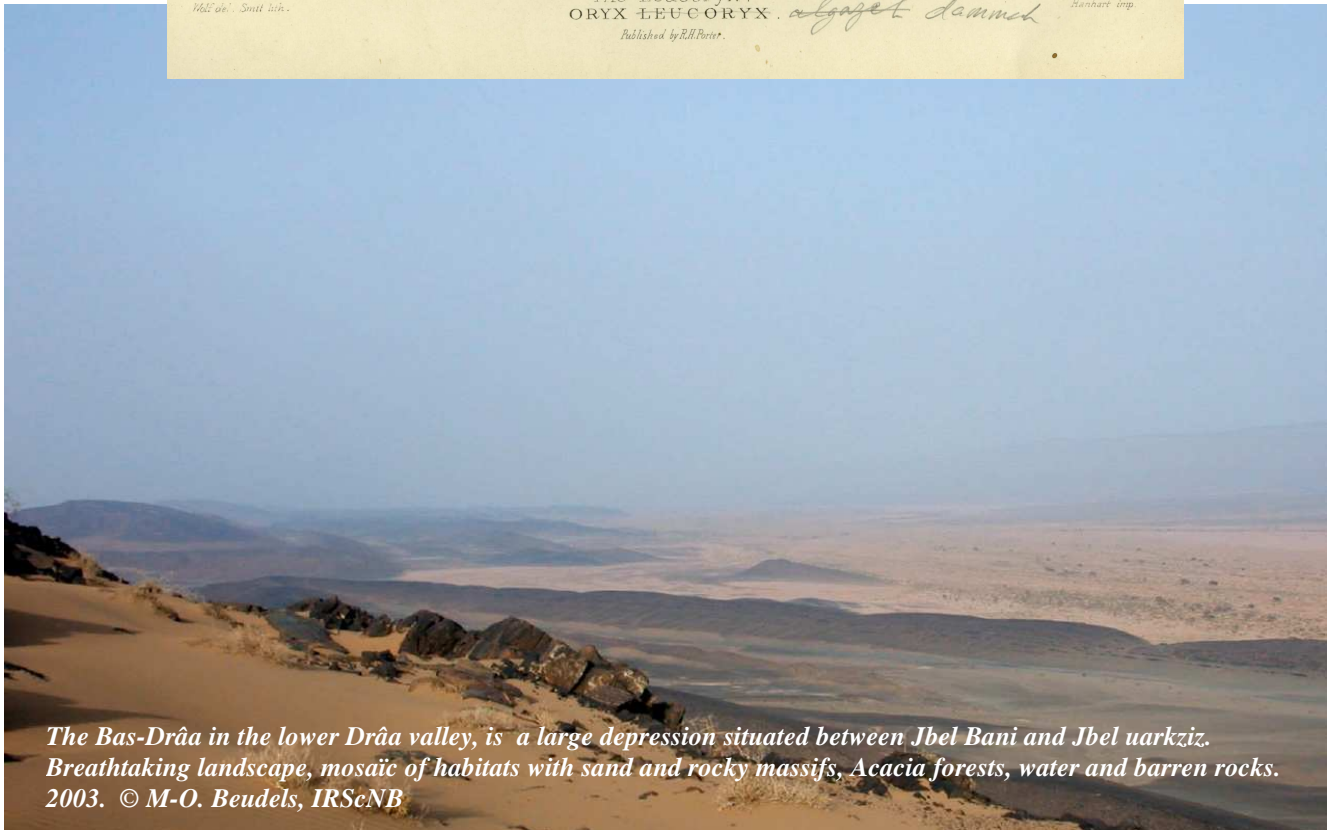
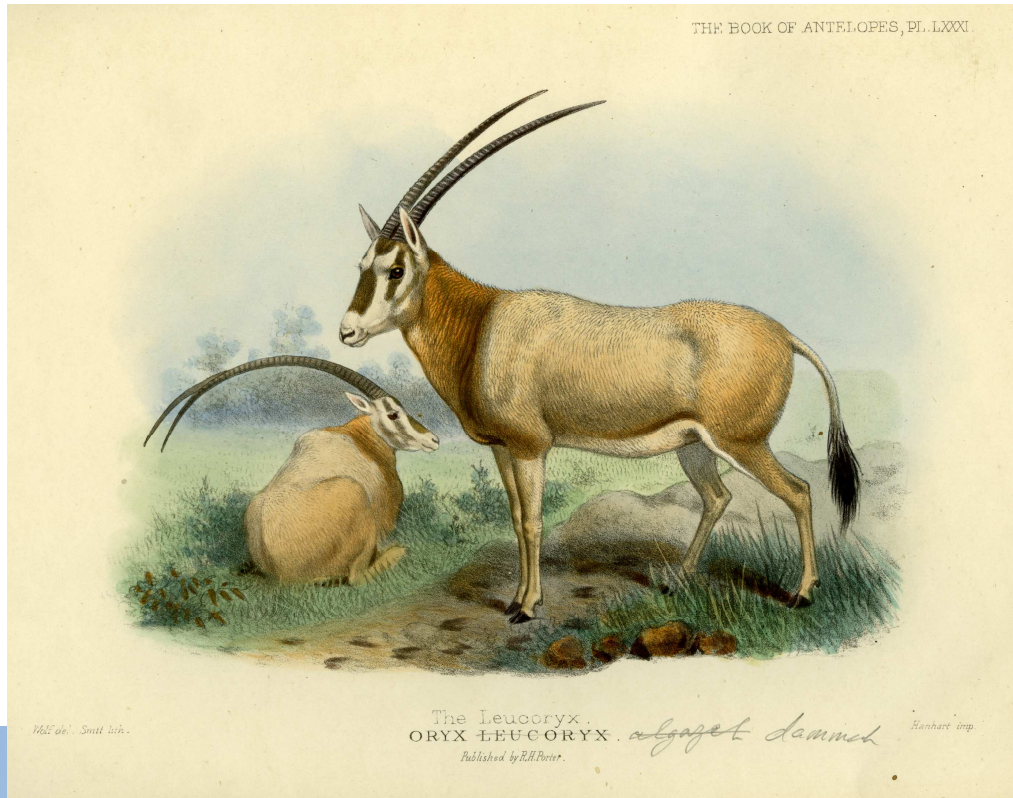


Oryx dammah



The Bas-Drâa in the lower Drâa valley, is a large depression situated between Jbel Bani and Jbel uarkiz. Breathtaking landscape, mosaic of habitats with sand and rocky massifs, Acacia forests, water and barren rocks. 2003. © M-O. Beudels, IRScNB

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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).

1.2. Nomenclature.

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

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 coloration 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

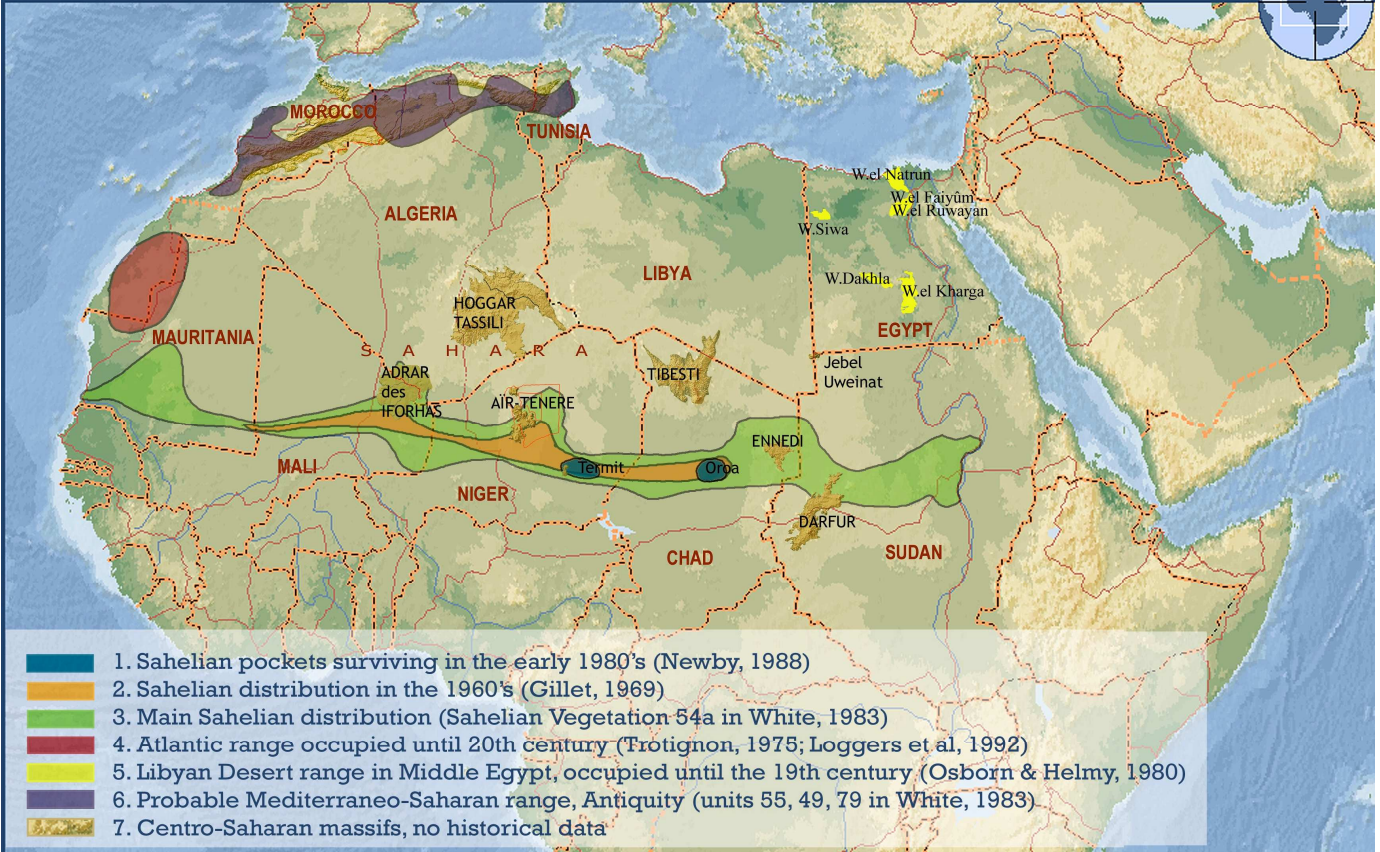
2.1. General biology

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.



- 1. Sahelian pockets surviving in the early 1980's (Newby, 1988)
- 2. Sahelian distribution in the 1960's (Gillet, 1969)
- 3. Main Sahelian distribution (Sahelian Vegetation 54a in White, 1983)
- 4. Atlantic range occupied until 20th century (Frotignon, 1975; Loggers et al, 1992)
- 5. Libyan Desert range in Middle Egypt, occupied until the 19th century (Osborn & Helmy, 1980)
- 6. Probable Mediterraneo-Saharan range, Antiquity (units 55, 49, 79 in White, 1983)
- 7. Centro-Saharan massifs, no historical data

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0 km 500 1000 1500 2000 2500

Royal Belgian Institute of Natural Sciences



Acacia ehrenbergiana. Niger. 2004. © John Newby



Oryx dammah in the 6000 ha fenced Oued Dekouk Nature Reserve. © R.C.Beudels-Jamar - IRScNB



FIG. 88. — *Acacia*, I (d'après CORSON, d'ap. DELILE et d'ap. CHEVALLIER, modifié).

Acacia. in P. Ozenda. 1991. Flore et végétation du Sahara. CNRS.

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.

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).

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 (Ratray, 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 (Ratray, 1960; White, 1983; Ozenda, 1991), on the periphery of entral Saharan mountains (Ratray, 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 Ratray (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 tenasissima* and *Lygeum spartum* (Ratray, 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 Ratray'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



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

between the Atlantic, where it descends to 27° N, and Tunisia (Ratray, 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-Saharan, in particular, the Bubal, *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.



Bas-Drâa valley, Morocco. 2003 © Marie-Odile Beudels.

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 Air 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 Ajers 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.



Dakhla, Morocco
© Marie-Odile. Beudels.IRScNB

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).



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

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). 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.

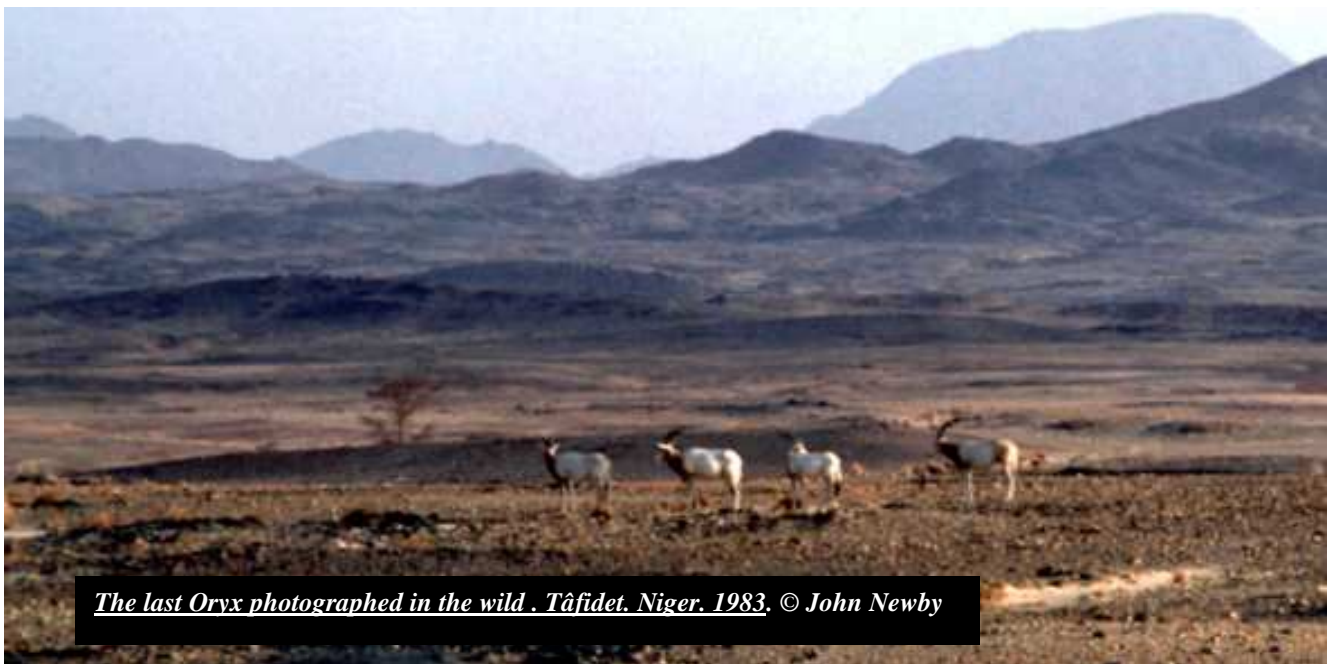
The range of the Scimitar-horned Oryx has regressed continuously since Antiquity. The northern sub-Saharan range ceased supporting permanent populations at an unknown date, but almost certainly before the 19th century and in any case by the second decade of the 20th century. (Lavauden, 1920; Kowalski 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. Figure 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 hypothetic presence of Scimitar-horned Oryx in the Sahelian regions of northern Chad, in the Ouadi Rimé-Ouadi Achim region, south 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 Rzebiak-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; Sournia 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 Mediterraneo-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 Mediterraneo-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 cortège 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 Ajjers, 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 Mediterraneo-Saharan range	Tunisia	Bou Hedma, Sidi Toui, Dghoumès, Oued Dekouk
	Morocco	Drâa
Saharo-Atlantic range	Morocco	Dakhla
Libyan Desert range	Egypt	Oases, in particular Siwa
Centro-Saharan massifs	Algeria	Hoggar, Tassili des Ajjers

2.3. Evaluation and evolution of populations

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 (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 Air, 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 Ajjers 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).



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



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



*Ouadi Achim (OROAGR) and
Oryx horn. 2002. © Tim Wachter- ZSL*



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



Sahelian grassland with nomads. Chad. © John Newby

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; 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 (14 males, 9 females) (Jebali, octobre 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).

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).

Vegetation outside and inside a protected area. Bou-Hedma NP. Tunisia. 2005. © Edward Spevak. Cincinnati Zoo & Botanical Garden.



Desertification. Niger.Chad © John Newby



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



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 led 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).

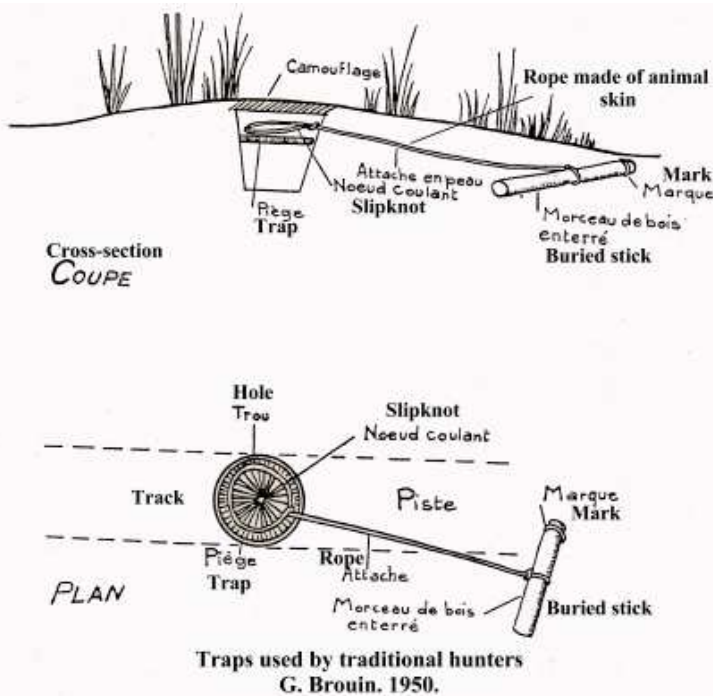
Cutting of woody plants. Woody plants seem to be essential to the Oryx, for shade and for food. Their systematic destruction in the Sahelo-Saharan region is an historical constant (Le Houérou, 1986). It increased sharply in recent times in the southern fringe of the Sahara, under the combined effects 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.



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

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.

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.

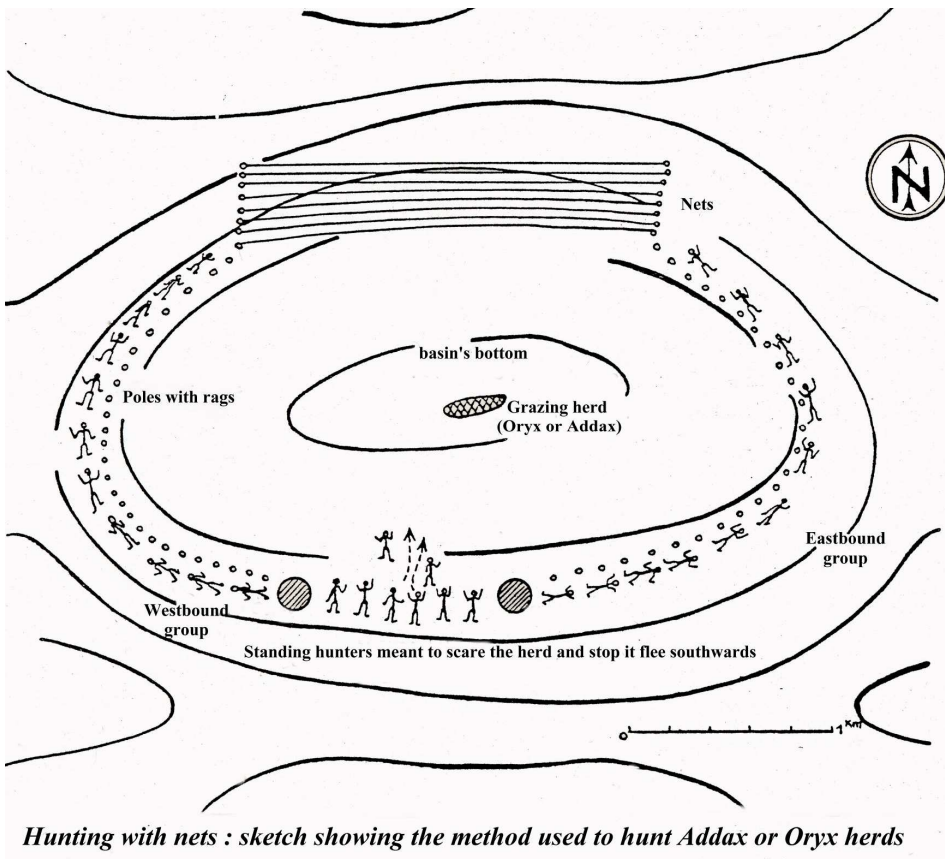
5. REGULATORY PROVISIONS

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.



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.



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

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.

Tunisia



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

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).

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).

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 (Oct, 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).



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

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.



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

Niger

A semi-captive raising programme is being envisaged at Gadabedji ranch, 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).



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Preservation Trust.



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

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.

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.

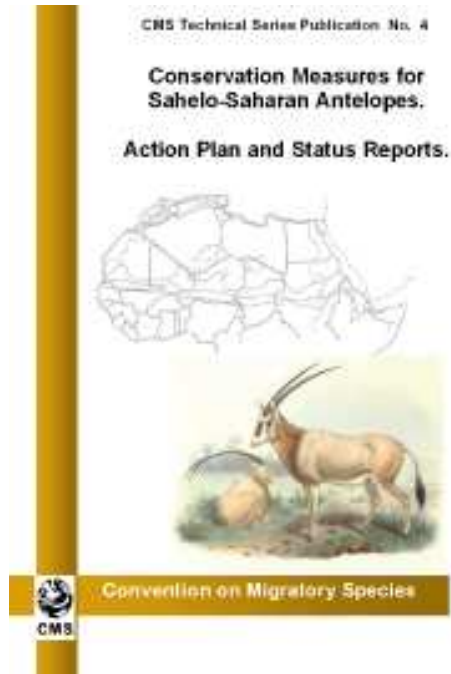
Establishment of a network of protected zones in all parts of the historical range, based on the guidelines of paragraph 2.2.4., with absolute priority given to zones where the species last occurs in the wild, specifically, firstly, the Ouadi Rimé-Ouadi Achim Reserve in Chad, secondly, Niger.

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.

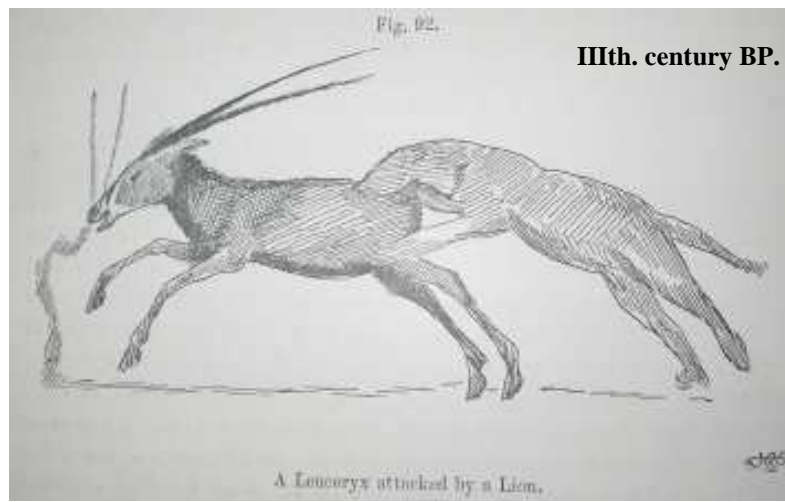


Bou Hedma. © Tim Woodfine. Marwell Preservation Trust.

In the 70's



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



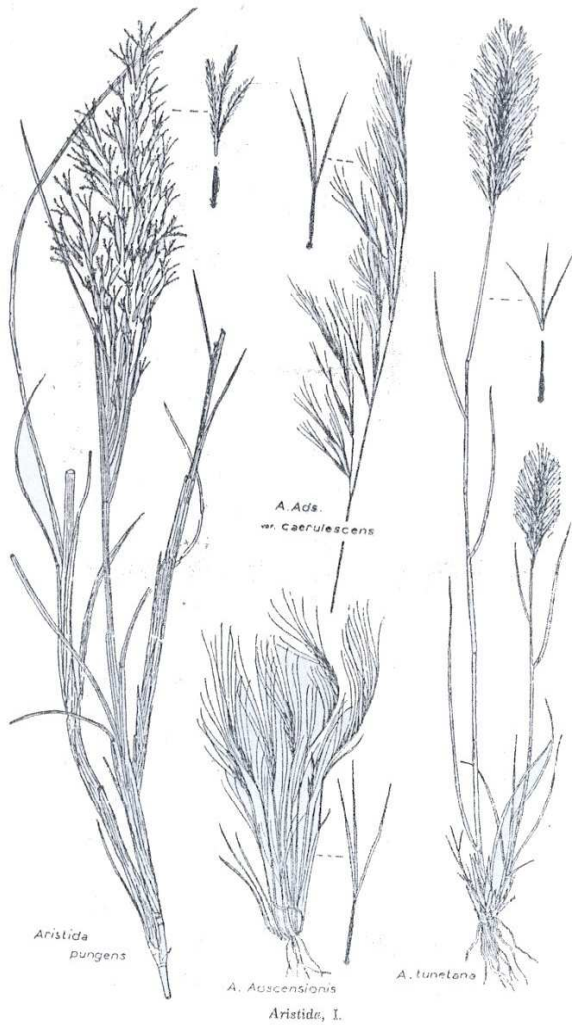
Oryx attacked by a lion. Sketch made in 1890 by Sir Harry Johnston from a mosaic. Bardo Museum - Tunis. in Sclater. P.L. & O. Thomas. 1899.



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

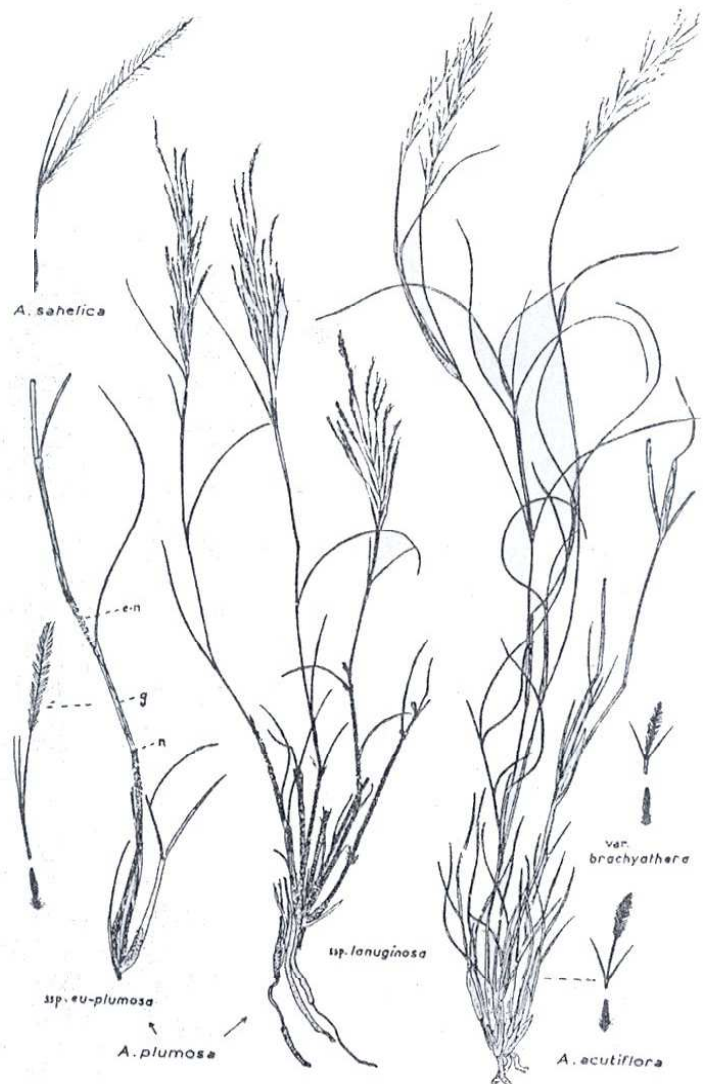


Oryx. Oued Sidi Toui NP. Tunisia. © Roseline C. Beudels-Jamar-IRScNB.



Aristida

FLORE DU SAHARA



“Flore et végétation du Sahara” by
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— *Aristida* (fin). Voir légende de la figure 31



Cornulaca monacantha

Panicum turgidum



Cornulaca monacantha

LÉGUMINEUSES

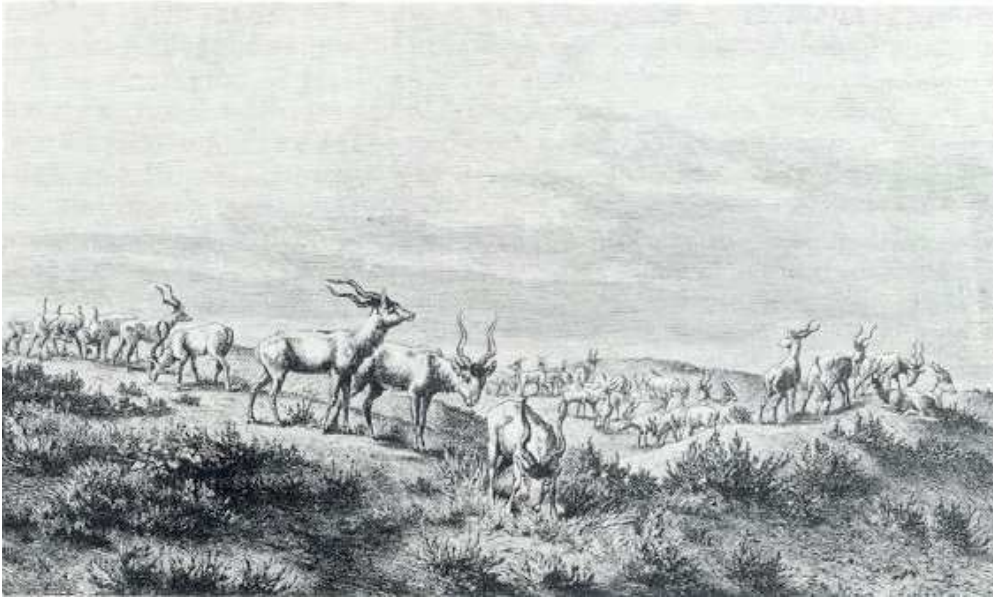


Retama retam

— 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.

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



*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*



Tin-Toumma. North-East of Termit. Niger. 2004. © John Newby