ARABIAN ORYX
REGIONAL CONSERVATION
STRATEGY AND ACTION PLAN

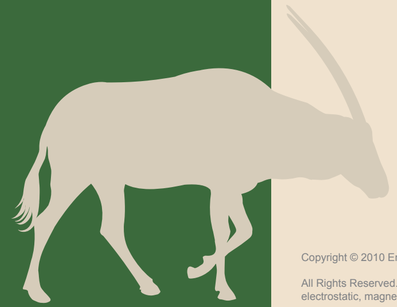
هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

General Secretariat for the Conservation of the Arabian Oryx

AUTHORS
Environment Agency – Abu Dhabi (EAD)
The Coordination Committee for the Conservation of the Arabian Oryx (CCCAO)
IUCN/SSC Antelope Specialist Group (ASG)

PUBLISHED BY
Environment Agency – Abu Dhabi
P.O. Box: 45553, Abu Dhabi, UAE
Tel: +971-2-4454777, Fax: +971-2-4463339
www.ead.ae

PHOTOGRAPHY BY
Abdulnasser A. Al Shamsi
Myyas A. Al Quarqaz



CONTENTS

FOREWORD 5
PREFACE 7

1 INTRODUCTION 8
1.1 The Conservation Strategy Workshop 8
1.2 Background 8
1.2.1 Description 9
1.2.2 Habitat 10
1.2.3 Diet 10
1.2.4 Reproduction 11
1.2.5 Adaptations 11
1.2.6 Behaviour 12
1.2.7 Predators 12
1.3 Former Distribution and Decline 12
1.3.1 Establishment of Captive Breeding Herds 13
1.4 The Coordination Committee for the Conservation of the Arabian Oryx 14

2 CURRENT STATUS OF THE ARABIAN ORYX 15
2.1 Regional Summary 15
2.2 Range State Reports 17
2.2.1 Bahrain 17
2.2.2 Jordan 17
2.2.3 Kuwait 19
2.2.4 Oman 19
2.2.5 Qatar 20
2.2.6 Saudi Arabia 20
2.2.7 Syria 21
2.2.8 United Arab Emirates 21
2.2.9 Yemen 22
2.3 Captive Oryx Populations 22

3 PROBLEM ANALYSIS 23

4 CONSERVATION STRATEGY 28

5 IMPLEMENTATION 33

6 ACKNOWLEDGEMENTS 35

7 REFERENCES 36

8 APPENDICES 43
8.1 Arabian Oryx National Action Plan: Template. 43
8.2 List of Delegates 44
8.3 List of Range State Member Agencies 49

H.H Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and H.E Mohamed Al Bowardi, Managing Director of the Environment Agency – Abu Dhabi personally involved in the release of Arabian Oyrx back into the wild in 2007.

FOREWORD

The Arabian Oryx has always been admired for its beauty. It has been celebrated in Arab art and literature ever since the time of the Umayyad poet Omar ibn Abi Rabiah. The disappearance of this magnificent animal from the wild therefore represented a significant loss not only for the biodiversity of the Arabian Peninsula but also for its cultural heritage.

The far-sighted vision of the late Sheikh Zayed bin Sultan Al Nahyan ensured that before the last herds finally disappeared, enough wild individuals were brought into captivity to found viable breeding groups, both internationally and within the region. Descendants of these oryx have been reintroduced into the wild at several sites across the Arabian Peninsula. These initiatives serve as inspiring examples of what can be achieved. It is now time to apply a similar long-term vision to build on these successes and restore oryx populations more widely across their ancestral range.

I'd like to take this opportunity to express our gratitude to H.H Sheikh Khalifa bin Zayed Al Nahyan, President of the UAE, for his constant support as well as H.H Sheikh Mohammed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi, for his personal involvement in the release of the Arabian Oryx.

The Government of the United Arab Emirates is committed to Arabian oryx conservation. The development of this strategy is an essential step in coordinating efforts at a regional level and thereby maximising the effectiveness of future conservation interventions.

We urge all range states and stakeholders concerned with oryx conservation to adopt the recommendations outlined in this strategy so that the Arabian oryx may once again become a familiar inhabitant of the plains and deserts of Arabia.

H.E MOHAMED AL BOWARDI

Managing Director,
Environment Agency – Abu Dhabi

PREFACE

The Environment Agency – Abu Dhabi (EAD) is honoured to host the General Secretariat of the Coordinating Committee for the Conservation of the Arabian Oryx.

As a result of the oryx conservation initiatives that have already taken place, a considerable amount of experience and expertise in captive management, breeding, and planning and implementation of reintroduction operations has been built up within the region. Together, with the commitment to oryx conservation shown by all range states so far, this provides a sound basis for future action. We now have the expertise and tools to achieve our common vision of restoring the Arabian Oryx to its former range.

Re-establishing free-ranging oryx populations over extensive areas of the Arabian Peninsula is a challenging endeavour. Coordinating all the separate initiatives and working to a common timescale will assist considerably in achieving this goal. This strategy provides a framework for conservation action at the regional level and its completion is an important milestone that we are proud of.
However, this strategy is only one part of the process. Now we have to ensure that these recommendations are implemented effectively. This means making sure that the necessary financial and human resources are available to develop national action plans and ensure their success.

EAD is committed to supporting and facilitating Arabian Oryx conservation initiatives in partnership with other agencies. Together we believe we can secure a better future for the Arabian Oryx in the wild.

H.E MAJID AL MANSOURI

Secretary General,
Environment Agency - Abu Dhabi

1 INTRODUCTION

1.1 The Conservation Strategy Workshop

At the meeting of the Coordinating Committee for the Conservation of the Arabian Oryx held in Wadi Rum, Jordan in April 2007, it was agreed that the Environment Agency – Abu Dhabi, alongside its partners, would lead the development of a regional conservation strategy for the Arabian Oryx. All the range states present, endorsed this decision. The meeting further recommended that a workshop be held in Abu Dhabi to develop this regional strategy.

The Arabian Oryx Regional Conservation Strategy Workshop was held August 20-22, 2007 and was sponsored by the Environment Agency–Abu Dhabi (EAD). More than 40 delegates attended, representing Arabian Oryx range states, regional captive breeding centres, and other stakeholders. The workshop was facilitated by the IUCN/SSC Antelope Specialist Group and consisted of three parts: (1) Status Review; (2) Problem Analysis; (3) Strategy Development.

1.2 Background

Arabian Oryx (Oryx leucoryx), locally known as Al Maha, are endemic to the Arabian Peninsula. They are the largest of the antelopes that once grazed the plains and deserts of the region and are uniquely adapted to the extremely arid environment. Their distinctive appearance and elegant horns make them instantly recognisable and oryx feature frequently in Arabic poetry and painting, renowned especially for the beauty of their eyes. Arabian Oryx are also widely believed to be the source of the unicorn legend, based on the image of their horns as seen in profile. Indeed, the Ancient Egyptians are reported to have tied together the horns of young oryx to fuse them into a single horn. The oryx's charisma, ecological role and cultural significance make it an ideal flagship species for the fauna of Arabia.

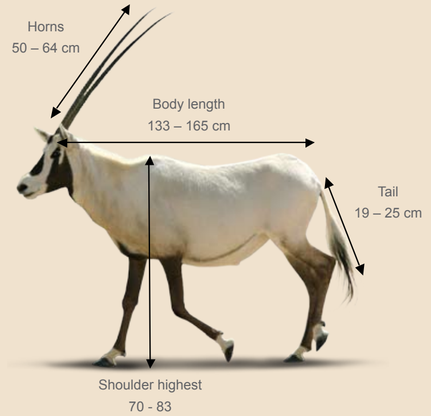
Sadly, despite these many qualities, oryx were relentlessly persecuted until the last wild individuals were hunted out around 35 years ago. The final disappearance of the Arabian Oryx from the wild represented a significant loss for biodiversity, both regionally and globally, but the event also galvanised conservation efforts that led, through captive breeding programmes, to the restoration of wild populations. These reintroduction initiatives have become a classic conservation success and serve as a model for similar programmes worldwide.

Arabian Oryx is classified as Endangered on the IUCN Red List and it has been listed on Appendix 1 of CITES since 1975.

Many studies on captive and released oryx populations have been carried out over the last 20-30 years, producing a large amount of information on its biology (see References).

1.2.1 Description

The Arabian Oryx is the smallest of the four species in the genus Oryx. Head-body length is 133-165 cm and height at the shoulder is 70-83 cm. There is a small hump above the withers. Males weigh 65-90kg (possibly more) and females 54-70 kg. The horns are black and similar in form in both sexes: they are long and slim, straight or slightly recurved, reaching 50-64 cm in length. Oryx are white in colour, with dark chocolate brown or black legs, a brown flank line and a white tail, tipped black. The face has a black or dark brown blaze and the cheeks and throat are also black, continuing down onto the chest. Some individuals show a more yellowish-buff ground colour and the extent and intensity of the dark markings is also variable and change between summer and winter. Young animals are light brown at first, gradually acquiring the white adult coat. Oryx may be conspicuous from a great distance in bright sunlight, but are much less so when resting in the shade. Oryx from southern Arabia have been described as a separate subspecies O. l. latipes, mainly on the basis of their larger hooves, but there seems little justification for accepting this form. [24]



1.2.2 Habitat

Oryx inhabit gravel plains, open wadis, sand dunes and stony inter-dunal depressions. They reportedly move into the sands after rain and in the winter return to the plains in hot seasons where they can find more shade. The presence of several of the last wild herds in sandy areas such as the Nafud and Rub Al Khali is likely to reflect the relative inaccessibility of these places and a last refuge from vehicle-borne hunters rather than a preferred habitat. The last known wild herd occurred on the Jiddat Al Harasis which is well-vegetated. Local bedu on the Jiddat Al Harasis report that greatest numbers of oryx occurred on the open plains and in broad wadis or haylahs where there is more vegetation. [24, 62]

1.2.2 Diet

Oryx mainly eat grasses and the shoots of trees and bushes and may wander long distances in search of pasture. One animal is known to have covered 93km in 18 hours. They can survive for long periods without drinking, apparently meeting their water requirements from succulent plants and occasionally from dew, but they drink freely when water is available. They feed mainly in the early morning, evening and possibly at night.

Arabian Oryx seen here in the Arabian Oryx Protected Area, UAE in Abu Dhabi, UAE

Young Arabian Oryx with light brown colouration

1.2.4 Reproduction

Gestation lasts for 255-273 days. Females usually give birth to a single calf, rarely to twins. There is no fixed rutting season. In the Arabian Oryx Protected Area, there was a birth peak in March and a trough in September but oryx have been born in all months. Males spar when competing for females and these fights may end in injury or death. In captivity, females give birth for the first time at 2.5-3.5 years. Calves can join the herd a few hours after birth. Captive oryx have lived for up to 19 years and in some breeding programmes exceeded 20 years.

1.2.5 Adaptations

Arabian Oryx are the most arid-adapted species of oryx and inhabit hyper-arid desert regions with annual rainfall of 50mm or less. The light-coloured coat is reflective, but in cooler winter conditions oryx erect the guard hairs and expose the darker skin to promote heat absorption. The brain is kept cool by a heat exchange system: warm arterial blood on the way to the brain is cooled in the enlarged sinus cavity by venous blood returning from the nasal passages. Oryx can go for long periods without drinking. The broad rounded hooves allow them to move easily over loose sand. [24, 62]

1.2.6 Behaviour

Oryx live in mixed herds, usually in groups of 10 or less, but in former times herds of up to 100 were reported. Herd size is known to increase following rainfall and improved grazing. Herds are usually led by an old female. In hot months, oryx seek shade below trees or bushes and may dig or scrape out a depression there or in the side of a dune. The usual gait is a walk or a slow canter. They tend to run only over short distances but can reach speeds of up to 60km/hour. In the Arabian Oryx Protected Area, male oryx established territories which they marked and defended. [62]

1.2.7 Predators

Wolves (*CANIS LUPUS*) would appear to be the only potential predator on adult oryx while in the northern part of their former range at least, Cheetahs (*ACINONYX JUBATUS*) might have been potential predators on younger animals. Caracals (*LYNX CARACAL*), Jackals (*CANIS AUREUS*) and large raptors, principally eagles (*AQUILA SPP.*) could also prey on small oryx. Brown-necked Ravens (*CORVUS RUFICOLLIS*) killed a 1.7 month old Oryx calf at Jaaluni, Oman [62] and some deaths in managed and wild herds have been attributed to snakebite. In Saudi Arabia it has been recorded that honey badger Mellivora capensis predates oryx calves. However, instances of natural predation on Arabian Oryx have rarely been reported and there are even reports of oryx impaling potential predators (*CARACAL, WOLF*) on their horns.

1.3 Former Distribution and Decline

Full details of the original distribution and status of Arabian Oryx are unknown, but they are assumed to have once occurred over all or most of the plains and deserts of the Arabian Peninsula. Oryx have been recorded from Jordan, Palestine, Syria, Kuwait, Iraq (west of the Euphrates), south through Saudi Arabia to the United Arab Emirates, Oman, and Yemen. Around 1800 they were also reported from Sinai, Egypt.

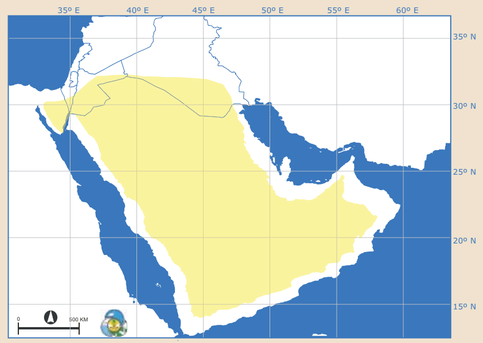
Arabian Oryx range had already contracted by the early years of the 20th century and the decline accelerated thereafter. The last records from the Dahana date from around 1917, [8] which left oryx distribution separated into areas over 1,000km apart: a northern population centred on the Nafud, and a larger southern population in and around the Rub Al Khali and the plains of central-southern Oman. Oryx disappeared from the north in the 1950s. In the south, their range steadily decreased as hunters eliminated them from their remaining refuges and by the 1960s oryx were restricted to parts of central and southern Oman. The last wild individuals were probably shot in 1972 on the Jiddat al Harasis. [62, 64]

The main cause of the extinction of the Arabian Oryx was relentless, uncontrolled hunting for sport, trophies and live animals. Oryx have been sought since ancient times by local hunters for their meat, hide and the supposed medicinal properties of the blood. However, the destructive potential of hunting intensified with the introduction of modern weapons and motor vehicles. The wide availability of 4WD vehicles after 1945 enabled hunting parties to reach all remote and previously inaccessible areas of the peninsula and sealed the oryx's fate. Their highly visible appearance, and open terrain they inhabit also makes them very vulnerable to motorized hunting and to capture from vehicles.

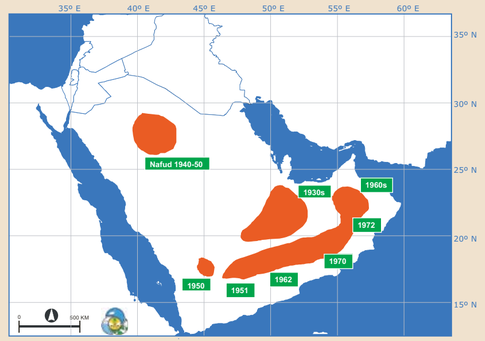
1.3.1 Establishment of Captive Breeding Herds

As the situation in the wild deteriorated, efforts were made to capture some of the remaining animals for captive breeding. An Arabian Oryx 'World Herd' was established at Phoenix Zoo, USA, made up of three animals live-caught by the Fauna and Flora Preservation Society in Yemen in 1962, four animals presented by HM King Saud of Saudi Arabia, one donated by H.H. Sheikh Jaber Abdullah Al Sabah of Kuwait and one donated by London Zoo. These animals were carefully managed and, supplemented later by further animals, increased and provided the stock for the first release back into the wild. [5, 21, 22, 27, 28, 81]

Captive herds were also established in the region, notably in Saudi Arabia, United Arab Emirates and Qatar, whose Ruler had organised expeditions to the Rub Al Khali to capture Arabian Oryx during the 1960's. These herds have all preserved separate blood lines and have made important contributions to the various reintroduction programmes to date.



Arabian Oryx Distribution before 1800 (Carruthers 1935)



Arabian Oryx Distribution during the 20th Century
(Stewart 1963; Stanley Price 1989)

1.4 The Coordination Committee for the Conservation of the Arabian Oryx

The International Abu Dhabi Conference for the Arabian Oryx hosted by the United Arab Emirates in March 1999 recommended the formation of a Coordination Committee for the Conservation of the Arabian Oryx (CCCAO). The Founding Conference of the CCCAO was held in Muscat in January 2000 and this meeting authorized the establishment of a General Secretariat and of an Arabian Oryx Fund. It was further decided that the UAE would act as Chairman of the Committee and that the General Secretariat would be hosted by Environment Agency-Abu Dhabi (EAD) in Abu Dhabi. The CCCAO's mission is to support all initiatives to protect and conserve the Arabian Oryx, to agree regional criteria and standards, and to coordinate efforts between range states. The second meeting of the CCCAO was held in Abu Dhabi Emirate, while the third meeting was held at Wadi Rum, Jordan over 3 days during April 2007 where agreement was reached on several issues. The most important outcome was a recommendation to develop a regional conservation strategy and action plan for the Arabian Oryx.

2 CURRENT STATUS OF THE ARABIAN ORYX

2.1 Regional Summary

Oryx living in the Arabian Peninsula today are either at release sites or in captive herds. The first and best-known initiative to release oryx back into the wild was the major operation undertaken in Oman from 1980 in the Arabian Oryx Sanctuary on the Jiddat Al Harasis, Oman. This reintroduction demonstrated the ability of captive oryx to adapt to wild conditions and provided a model for the re-establishment of oryx and other large antelopes, and was rightly regarded as a classic conservation success.. Reintroductions have also taken place in Saudi Arabia: Mahazat As Sayd (from 1990) and Uruq Bani Ma'arid (1995) UAE: Umm Al Zumoul (from 2007), and Jordan: Wadi Rum Area (2009).Other initiatives are in place or planned in Bahrain, Qatar and Syria.

Range state reports that follow summarise the current situation for each country and are based on presentations given at the conservation strategy workshop in Abu Dhabi in August 2007 and on the literature.

Fully free-ranging populations exist at only 2 sites: the Arabian Oryx Sanctuary, Oman, 'Uruq Bani Ma'arid, Saudi Arabia and Wadi Rum area, Jordan. All other populations are in fenced reserves of varying sizes and subject to different levels of management (including supplementary food and water, veterinary care, habitat enhancement, manipulation of social structure and breeding). There are also several captive breeding herds that are managed professionally and scientifically and many private collections. Table 1 lists the current herds and their status.

For the purposes of this report, the following definitions are used:
Free-ranging (not confined)
Part-fenced (oryx partly confined)
Fenced (oryx confined by a perimeter fence, trench, or sea (in case of island)
Unmanaged (no management measures of any kind)
Part-managed (some of supplementary forage/water provided, and/or habitat manipulation or improvement; and/or veterinary assistance)
Managed (all of the above)
Captive Breeding (confined, fully-managed, including controls on breeding)

Table 1. Current Status of Arabian Oryx Releases in the Arabian Peninsula Region (adapted from M. Shobrak 2007)

Country	Area (km²)	Year released	Number of oryx	Type
Bahrain				
Hawar Island		1994	29	Fenced, managed
Jordan				
Shaumari	22	1978	70	Captive Breeding
Wadi Rum	550[1]	2002	2	Fenced[2], Managed
Oman				
Arabian Oryx Sanctuary	2,824[3]	1982	60[4]	Free-ranging[5]
Saudi Arabia				
Mahazat As Sayd	2,244	1990	>800	Fenced, Unmanaged
'Uruq Bani Ma'arid	12,500	1995	150	Free-ranging
Syria				
Al Talila	220[6]	1996	116	Fenced, Managed
Qatar				
Al Amsahbiyah		1997	780	Fenced, Managed
As Shahaniyah		1979		Fenced, Managed
Ras as-Sharj		1991		Fenced, Managed
United Arab Emirates				
Dubai Desert Conservation Reserve	225	2003	>250	Fenced Part-managed
Arabian Oryx Protected Area	10,000	2007	94	Part-fenced Part-managed

[1] Pre-release enclosure 10km²
[2] Release area unfenced
[3] Reduced from 34,000 in 2007
[4] All male
[5] Fencing planned
[6] Oryx in 10km² enclosure

2.2 Range State Reports

2.2.1 Bahrain

A captive breeding programme for Arabian Oryx began in 1978 at Mahmeeyat Al Areen (8km²) with a founding group of six animals (4:2) donated by King Mohammed bin Issa Al Khalifa. Numbers now total 47. In February 1999, a breeding group of six oryx was transferred to Hawar Island. This population ranges freely on the island and has now increased to 29 animals. A third herd (14 in total) is kept in a captive breeding enclosure at Musayeej el Ikhtar. The total number of oryx currently held in Bahrain is 90. Oryx from Bahrain breeding programmes have been sent to Oman, UAE, Saudi Arabia, Qatar and the USA either for reintroduction programmes or to diversify the genetic base of those herds.

2.2.2 Jordan

Oryx were finally extirpated in Jordan in the 1930s due to hunting, organised trapping, natural disaster and mortality due to poisoning during a campaign to eradicate locusts. In 1978 The Royal Society for Conservation of Nature (RSCN) facilitated a reintroduction programme in Shaumari Reserve (22km²). This began with a founder herd of 11 animals: 8 (4:4) originating from San Diego and 3 (1:2) from the private collection of the Emir of Qatar. In 1984, 3 males from Zurich Zoo were added to the herd. Breeding occurred successfully and the population reached 200 by the year 2000, a total that exceeded carrying capacity of the reserve. This resulted in a decline in vegetation cover, habitat degradation, increased mortality, lower birth rate, and problems of inbreeding. Numbers in Shaumari have since been reduced to 70 through a programme of transfers to other centres and collections.

A reintroduction programme in Wadi Rum, southern Jordan, began in 2002 and is currently being implemented in collaboration with RSCN and AZESA. Ten oryx were initially transferred from Shaumari to a 4km² enclosure in a pilot project to investigate the adaptability and behaviour of Arabian Oryx. Six more animals have been added since then and all have been moved to an enclosure 8km² in area.

Wadi Rum provides a challenging environment and some oryx have had difficulty in adapting, even falling from rocks and cliffs. Disturbance from tourists has also been a negative factor. There is a lack of financial resources and technical expertise for the Arabian Oryx programme in Wadi Rum. Currently, it is planed to move the oryx away from areas used by tourists and to acclimatise them in a 720km² sector of the reserve (15% of the area). Efforts are being made to protect the oryx against other threats, such as hunting by local people. Future priorities are capacity building for the Wadi Rum Arabian Oryx team; further releases into the wild and an increase in regional cooperation. Potential release sites have been identified along the border with Saudi Arabia and it is hoped to establish a trans-border population there, in cooperation with the Saudi authorities. [1, 23, 25]

On July 27, 2009, Environment Agency-Abu Dhabi (EAD) released the first 20 oryx (8 males, 12 females) into Wadi Rum Protected Area. The animals were fitted with satellite collars to allow their progress to be monitored.

2.2.3 Kuwait

Arabian Oryx formerly occurred in the deserts of western Kuwait but have long been extinct there. Jal Az-Zor National Park (330km^2) was established in 1990 and is fenced to limit incursions by poachers and livestock.
The Kuwait Institute for Scientific Research (KSIR) has proposed the reintroduction of Arabian Oryx to Jal Az-Zor NP. This initiative is still at the planning stage. Several captive oryx breeding herds are maintained in the country. A captive oryx from Kuwait was contributed to the founding group of the World Herd in 1963. [35]

2.2.4 Oman

The last wild oryx in Oman were reportedly shot in 1972. The reintroduction project based in the Arabian Oryx Sanctuary on the Jiddat Al Harasis began in 1980. Many detailed accounts of the operation are available. The project commenced with 10 Arabian Oryx from the World Herd and was seen as a test case on the feasibility of reintroduction of a large mammal as a species conservation tool and a demonstration of the adaptability of captive-born oryx. The project enjoyed considerable success and oryx numbers increased steadily, reaching more than 400 by 1996.

The management focus also progressed: from 1980-1990 it was individual-based, reflecting the small numbers; 1990-1996 it moved to being population-based, and from 1996 on, was female-based.

In 1996 a major poaching problem began, focused first on young animals then on live-capture of females to supply private collections in the region. Despite many attempts to control it, poaching caused a sharp decline, particularly in the number of females. In 1998, some females were recaptured to form a new breeding nucleus.

Now, fewer than 60 oryx remain in the AOS, all males. In July 2007 the captive breeding herd contained 180 oryx, mainly females and a further 150 are held at the Omani Mammal Breeding Centre, Muscat. A dedicated anti-poaching unit is currently being established in the Arabian Oryx Sanctuary and is expected to be deployed before the end of 2007.
Oman is also working with all GCC countries on controlling the illegal trade in wild-caught oryx. In 1997 work began on an ecotourism plan to operate alongside the Jaaluni project and increase the income of the local people. [34, 57, 58, 61, 62, 70]

In 2007 the government of Oman reduced the area of the Arabian Oryx Sanctuary from 34,000km^2 to 2,824km^2. Fencing of the remaining area is underway as a further protection measure.

2.2.5 Qatar

Some oryx were brought to Qatar from the Rub Al Khali in the 1950s-1960s and kept in private collections, including those at As Suleimi Farm, Al Tereinat Farm, and Ma'ader Farm. It is estimated that about 120 animals currently live on farms.
In 1978, Qatar donated oryx to Saudi Arabia, Jordan, Kuwait, Bahrain and UAE. In 1979, As Shahaniyah Reserve was established for Arabian Oryx conservation and 25 animals were transferred there from Ma'ader Farm. In 1993 a reserve was established by a decree of the Emir and herds were managed scientifically and measures taken to prevent losses due to disease. Some oryx have been distributed to new reserves: Ras as-Sharj in the north (1991) and Al Amsahbiyah in the south (1997). Some animals were donated to Doha Zoo and other private collections. By the end of 2006, Arabian Oryx in Qatar reserves totalled 780. Qatar has contributed to the conservation of Arabian Oryx through donations to the World Herd and to several reintroduction projects.

2.2.6 Saudi Arabia

Arabian Oryx were formerly widely distributed in the Kingdom but were extirpated by the early 1970s or earlier. Restoration of the Arabian Oryx to the wild in Saudi Arabia is a core program of the National Commission for Wildlife Conservation and Development (NCWCD) and has support from all levels of government. The reintroduction program has two main components: scientific management of captive breeding herds and establishment of large protected areas into which oryx and other indigenous species can be released. Two releases have taken place so far and several areas have been identified for future releases, based on the NCWCD Protected Area System Plan. A scientifically-managed captive breeding herd was established at NWRC in Taif in 1986. This was based on animals from the collection of the late King Khaled which contained unique genetic material. A 'three generation management' system has since been developed. Oryx were first released at Mahazat as-Sayd protected area (2,244km^2) which was completely fenced in 1989 to prevent access by poachers and livestock. Releases began in 1990. The founder herd was as diverse as possible and comprised animals from national and overseas collections as well as the NWRC herd. Numbers are now more than 800, a total that exceeds estimated carrying capacity and is presenting problems of overgrazing and habitat deterioration. In addition, a series of droughts in the years since 1999 has led to mass mortality of oryx there. [29, 30] The second release site is 'Uruq Bani Ma'arid (12,000km^2) situated on the western edge of the Rub al-Khali. This reserve is unfenced and releases commenced in 1995. Population increase has been slower than in Mahazat as-Sayd and numbers are currently estimated at around 150. A limiting factor here is prolonged drought and some poaching incidents have been reported, but the frequency seems to have decreased.

Several other sites have been identified for potential release. These include a cluster of three protected areas in the north: Harrat al-Harrah (12,150 km^2), Al-Khunfah (20,450 km^2) and At-Tubaiq (12,200 km^2). All lie close to the international borders with Jordan and Syria and offer the prospect of regional cooperation, but the optimum conditions for release have not yet been reached. Other protected areas identified within the former range of the oryx include three in and around the Rub al Khali (Al-Hibakah, 'Uruq al-Mu'taridah, and Shiqqat Najran) and two in the Nafud (Nafud al-Urayq and Jabal 'Imran). [7, 9, 18, 40, 43, 48, 56, 65, 67]

Draft national action plans and strategies have been developed. [55, 80]

2.2.7 Syria

Al Talila Reserve, 30 km south-east of Tadmur (Palmyra) was established in 1991 as part of a project to protect the cultural heritage of the Arabian desert, to re-establish Arabian Oryx and Goitered Gazelle (Gazella subgutturosa marica) and to restore the Syrian steppe rangeland.
The reserve covers 220km^2 and is protected by a perimeter trench. In December 1996, 8 oryx (4:4) were transferred there from Shaumari Reserve, Jordan. The animals were placed in an enclosure for 1 month to adapt, then released into the main enclosure which covers 10km^2.
Four water tanks are provided for the oryx and the gazelles and some forage and vitamins are also provided. The animals have reproduced successfully and the oryx herd now numbers 116, though mortality is relatively high. This is partly due to fighting between males; 14 male oryx are currently kept isolated due to their aggressive behaviour. Nine oryx have been transferred to Al Adhani Reserve in Halep Governorate. Future plans are to increase the number of oryx and release them into suitable areas of natural habitat. This will require further capacity-building and training and securing the necessary funding for these operations.

2.2.8 United Arab Emirates

Arabian Oryx formerly occurred in the deserts of the western UAE.
The UAE is currently home to more than 3,000 captive Arabian Oryx, representing over 50% of the regional total. Around 2,000 of these animals are in Abu Dhabi. Oryx were released into the fenced Dubai Desert Conservation Reserve in 1999. This reserve covers an area of 225km^2 and oryx now number more than 250. Some supplementary feed (grass, alfalfa) and fresh water are supplied and around 6,000 native trees have been planted to provide shade. As a result of these management interventions, oryx density in DDCR is relatively high. [13]
A second project, implemented by EAD, has reintroduced Arabian Oryx into a large area of natural habitat in the south-east of UAE, the Arabian Oryx Protected Area. This covers 7,904km^2 at Umm al Zumoul, on the borders with Oman and Saudi Arabia and consists of sand dunes, sand-sheets, gravel flats and sabkha. The area is currently fenced around approximately 75% of the perimeter. 98 animals have been released since 2006 in three separate sites and are monitored using satellite/GPS tracking techniques. The animals originated from three collections: Sir Bani Yas Island, Al Ain Zoo, and a private collection. Release of a further

100 oryx is envisaged over the next 5 years. A large number of trees have been planted in cooperation with the Forestry Department and water is provided as temporary measure. [2]

The late Sheikh Zayed bin Sultan Al Nahyan, former President of the UAE, founded a valuable breeding herd of oryx in Abu Dhabi that has furnished stock for reintroductions. There are several other breeding oryx herds in the UAE including Al Ain Zoo; Sharjah's Breeding Centre for Endangered Arabian Wildlife, and several more private collections in Abu Dhabi and Dubai.

2.2.9 Yemen

Oryx occurred historically in areas bordering the Rub Al Khali in northern parts of Hadhramaut and Mahra Governorates. Three oryx captured in Wadi Mitan in the easternmost part of the country in 1962 formed the nucleus of the original World Herd. At present the only oryx in the country consist of two males in Sana'a Zoo, donated by BCEAW. Females are currently being sought to establish a breeding population. A long-term proposal to reintroduce Arabian Oryx to their natural habitats in Yemen is being supported by the Environment Agency Abu Dhabi (EAD). Extensive areas of suitable oryx habitat are available in the Ma'rib Desert, Shabwa Governorate, and in northern parts of Hadhramaut and Mahra. The principal threat facing re-establishment of a free-living oryx population in Yemen lies in the unregulated killing of wildlife. Possession of automatic weapons is widespread and there is a general lack of awareness of the importance of biodiversity conservation. Substantial training and transfer of technical expertise are needed as well as a nation-wide awareness raising programme.

2.3 Captive Oryx Populations

Oryx are held in captivity in collections throughout the region and internationally. Arabian Oryx are easy to keep and breed in captivity and the total number currently held in so many different centres ensures that the survival of the Arabian Oryx genome is assured. Animals in European, North American, and Australian collections are carefully managed with the aid of an international studbook. Many well-managed captive herds also exist within the region.

Captive breeding remains important to maximise genetic diversity and guard against stochastic catastrophe (disease, drought etc.) among released herds. However successful reproduction in some release sites such as the Arabian Oryx protected area, UAE and Mahazat as-Sayd has begun to provide wild-bred animals for release elsewhere and allowed a reduction in captive breeding efforts in Saudi Arabia. In view of this, there is a need to identify the aims and priorities of the current captive breeding programme at an overall level.

3 PROBLEM ANALYSIS

The range state reports included a summary of threats and problems facing oryx conservation at national level. One session of the workshop was devoted to an analysis of problems and threats facing the Arabian Oryx at the regional level. Workshop participants examined these in four groups: Threats to wild populations; Threats to managed herds; Constraints (factors preventing implementation of conservation measures) and Gaps (in knowledge, data, capacity, resources). Each threat/problem was further assigned to a category of severity from 1-3, with 1 representing the most serious level of threat. All the identified threats were presented to the full workshop and formed the basis of an informed discussion. Several factors were common to more than one group. During the plenary session the list was further refined and possible solutions were discussed. Table 2 presents the results of the problem analysis.

Table 2. Problems and Threats

PROBLEMS AND THREATS	Level
THREATS TO WILD POPULATIONS	
Poaching and illegal trade	1
Habitat loss and habitat degradation	1
Oil and gas exploration (Jiddat al Harasis and Mahazat as-Sayd)	2
Lack of effective law enforcement	2
Disease transmission	3
Lack of long-term sustainable management	3
Ability of captive-bred oryx to survive in the wild	3
THREATS TO MANAGED HERDS	
Habitat degradation	1
Disease and inbreeding	1
Herd structure, sex and age balance	2
Lack of clear objectives and planning	2
Exceeding carrying capacity	2
Lack of agreed management standards	3
CONSTRAINTS	
Oryx conservation projects are not a national priority for range states	1
Multiple agencies are responsible for oryx management programs.	1
Degradation of habitats and difficulty in restoration	2
Identification of suitable new release sites	2
Weak regional coordination	2
GAPS	
Capacity in breeding and reintroduction techniques	1
Long-term funding for release projects	1
Lack of public awareness of oryx conservation	1
Inadequate knowledge of oryx forage and water needs	2

Hunting

It was clear from the status review, the working group results and the plenary discussion that hunting remains the most important threat confronting establishment of free-ranging oryx herds and impacting on the survival of existing ones. Uncontrolled hunting for sport, trophies or meat was responsible for the first extinction of the Arabian Oryx. Illegal live-capture over the last ten years has caused the catastrophic decline in the Oman oryx herd and poaching incidents have occurred in ‘Uruq Bani Ma’arid in Saudi Arabia. Hunting is a well-established tradition, deeply ingrained in local societies throughout Arabia and oryx are a relatively easy prey.

The logistical challenge inherent in protecting vast tracts of desert should not be underestimated: events in the Arabian Oryx Sanctuary have already demonstrated the difficulty in patrolling a large protected area with an open perimeter. Lessons learned in Oman, particularly the need for a trained and specialised oryx protection force and for clear legal procedures will contribute to future efforts safeguard reintroduced populations.

The problem becomes far more acute when animals range outside protected areas. The arid environment of the Arabian Peninsula has a low primary productivity so oryx occur at naturally low densities and viable populations need extensive areas of habitat. Irregular rainfall over much of their distribution adds a further pressure and predisposes oryx to wander long distances in search of good pasture, bringing them into greater contact with people and hunters.

This is a severe impediment to the future establishment of free-ranging population nuclei that can intermingle over large areas. The implication is either that very large protected areas are needed, or a strategy has to be planned for buffer zones including conservation outreach programs in communities surrounding release sites.

Habitat Destruction and Degradation

All the working groups identified this as a major problem. The growth in livestock numbers and pastoralists’ increased capacity to transport sheep and goats over wide areas by 4WD vehicle has increased pressure on rangelands across the Arabian Peninsula. The result is widespread overgrazing and deterioration in pasture quality. Exclusion of livestock rapidly promotes improvement in rangeland condition as demonstrated in several places, e.g. Mahazat as-Sayd, Al Talila, and Shaumari reserve. However, long-established traditional grazing and land-use rights are widespread so the scope for livestock exclusion is limited and integrated land use strategies and rangeland management plans are needed everywhere. This further emphasises the need for community involvement in oryx programs

Genetic Issues

In any species with a relatively limited group of founders, genetic issues are always significant. The need to maximise genetic variation in captive, managed and released oryx herds is widely recognised, as is the need for genetic screening of individuals considered for release into the wild. Development of a regional studbook, as proposed in the Strategy, will facilitate this process. In future, contingency plans for exchange of individuals between sub-populations may have to be considered to maintain maximum diversity, depending on the size of herd, the genetic variation in the founder group, and post-release genetic drift. It is also important to consider the reported problem of outbreeding depression in release programs as well as potential inbreeding depression.

Establishing New Oryx Populations

There is wide agreement that the establishment of free-ranging oryx populations across substantial parts of the historic range in the Arabian Peninsula is a desirable long-term aim. A logical way to achieve this is by releasing animals at clusters of sites that could eventually link up to create metapopulations, enabling exchange of individuals and genetic variation and thus ensuring long-term fitness and sustainability. This requires strategic planning at the regional level. In fact, existing reintroductions and other sites identified for future releases potentially offer such possibilities in the north (Saudi Arabia, Jordan, Syria) and south (Saudi Arabia, Oman, UAE, Yemen) of the Arabian Peninsula, if all can be realised.

Some of the difficulties that have to be overcome in achieving sustainable free-ranging populations were referred to above. The alternative entails releasing oryx into fenced reserves. Such a policy allows hunting to be controlled or curtailed, but entails a different set of problems. Confined populations are more vulnerable to sub-optimal grazing conditions in years of drought and, more importantly, animals are prevented from moving to areas with higher rainfall and fresh pasture, disrupting the oryx's natural response to drought or lack of forage. Furthermore, carrying capacity becomes an inevitable issue sooner or later and implementation of a strategy to deal with excess animals is essential before overpopulation has an adverse effect on the vegetation cover and quality and on the genetic make up and health of the animals. The most desirable option would be to transfer animals to other release sites or back to captive breeding herds, but in some circumstances more drastic measures may be needed.

4 CONSERVATION STRATEGY

The procedure used to develop the Arabian Oryx Regional Conservation Strategy was a simplified logical framework approach. The Status Review summarised the current situation and the Problem Analysis identified the main obstacles to oryx conservation.

Workshop participants then formulated a long-term vision and a mid-term goal for Arabian Oryx conservation. Once these had been agreed, a set of objectives were identified that both addressed the main problems and allowed the goal to be reached. These procedures were again carried out in four working groups, followed by presentation to the full workshop, discussion, and agreement on a final version.

The working groups initially defined 23 objectives. Many of these were proposed by more than one working group and were refined and merged during the plenary discussion into seven core objectives. These objectives were subsequently broken down into more concrete targets and activities.

The vision and goal agreed at the workshop were:

VISION

VIABLE, SUSTAINABLE AND FREE-RANGING POPULATIONS OF ARABIAN ORYX OCCUR IN NATURAL HABITATS ACROSS THEIR HISTORIC RANGE AND IN HARMONY WITH LOCAL COMMUNITIES.

GOAL

TO DEVELOP A REGIONAL CONSERVATION PROGRAM FOR THE RESTORATION OF ARABIAN ORYX IN THEIR NATURAL HABITATS THAT ENSURES IT'S SURVIVAL AND CARRY OUT SUCCESSFUL REINTRODUCTION PROGRAMS IN NORTH AND SOUTH OF ITS HISTORIC RANGE

OBJECTIVES

Objective 1. Complete legislative process in all range states and enhance enforcement of wildlife legislation

Target 1.1. Existing wildlife protection laws reviewed and updated where appropriate

- Activity 1.1.1. Collect information on environmental laws in range states
- Activity 1.1.2. Unify different versions of laws relating to Arabian Oryx

Target 1.2. Laws relating to Arabian Oryx coordinated between range states

- Activity 1.2.1. Exchange information between range states
- Activity 1.2.2. Develop a unified Arabian Oryx conservation law.

Target 1.3. Personnel trained in law enforcement

- Activity 1.3.1. Develop training programmes
- Activity 1.3.2. Enhance legal awareness programmes
- Activity 1.3.3. Provide proper equipment and training

Target 1.4. Arabian Oryx conservation laws enforced in all range states.

- Activity 1.4.1. Stop poaching and hunting activities
- Activity 1.4.2. Ensure offenders are prosecuted

Objective 2. Enhance and increase wild oryx populations

Target 2.1. Current reintroduction programmes strengthened

- Activity 2.1.1. Review current reintroduction programs
- Activity 2.1.2. Develop site-based programs to enhance oryx numbers

Target 2.2. Reintroduction programmes for each range state developed and implemented.

- Activity 2.2.1. Carry out appropriate training for reintroduction activities
- Activity 2.2.2. Identify new release sites in each Range State
- Activity 2.2.3. Develop reintroduction strategy for selected sites

Target 2.3. Habitat condition in current and potential release areas assessed and defined.

- Activity 2.3.1. Carry out surveys to identify suitable habitats.
- Activity 2.3.2. Assess vegetation cover and quality in potential reintroduction areas
- Activity 2.3.3. Control overgrazing through integrated rangeland management plans
- Activity 2.3.4. Carry out EIA on all development projects potentially affecting Arabian Oryx

Objective 3: Establish a Regional Species Management Plan

Target 3.1: Demographic regional genetic assessment is conducted

- Activity 3.1.1: Develop regional proposal and gain approval
- Activity 3.1.2: Collect and analyse samples from all populations
- Activity 3.1.3: Identify important populations and individuals
- Activity 3.1.4: Prepare Final Report

Target 3.2: Arabian Oryx management protocol prepared and adopted.

Activity 3.2.1: Develop guidelines on herd management, transport, genetic value
Activity 3.2.2: Conduct a regional workshop
Activity 3.2.3: Approve and adopt final version of protocol
Activity 3.2.4: Publish the protocol

Target 3.3: Arabian Oryx release protocols prepared and adopted.

Activity 3.3.1: Best practice collated
Activity 3.3.2: Draft protocols circulated
Activity 3.3.3: Final version produced

Target 3.4: Aims of captive breeding programmes assessed and defined

Activity 3.4.1: Liaise with the breeding collections
Activity 3.4.2: Prepare and approve assessment criteria
Activity 3.4.3: Conduct the assessment and identify objectives
Activity 3.4.4: Prepare and distribute the assessment report.

Target 3.5: Arabian Oryx regional studbook developed.

Activity 3.5.1: Establish a working group
Activity 3.5.2: Collect information
Activity 3.5.3: Assess the available information and identify gaps
Activity 3.5.4: Prepare studbook first draft based on the available information
Activity 3.5.5: Finalise and publish Arabian Oryx studbook.

Objective 4. Secure public support for, and participation in, Arabian Oryx programs.

Target 4.1: Awareness and education programs and outreach program among RS established.

Range States

Activity 4.1.1. Produce & publish awareness materials (flyers, booklets and pamphlets)
Activity 4.1.2. Produce and publish media materials (especially documentaries)
Activity 4.1.3. Arrange informative workshops to address stakeholders.
Activity 4.1.4. Arrange field trips for different categories to reintroduction sites.
Activity 4.1.5. Enhance the Arabian Oryx General Secretariat website.
Activity 4.1.6. Adding relevant modules to school syllabus.

Target 4.2: Local community participation in conservation programs ensured

Activity 4.2.1. Involve local community & stakeholders in pre-release planning
Activity 4.2.2. Identify and implement opportunities for income generation through conservation or related activities

Objective 5. Build adequate region-wide capacity for all aspects of AO conservation

Arabian Oryx

Target 5.1. Regional capacity building programs developed & implemented

Activity 5.1.1. Carry out capacity gap analysis at regional and range state levels
Activity 5.1.2. Hold technical training workshops to fill gaps
Activity 5.1.3. Arrange rotational visits for field staff.
Activity 5.1.4. Arrange meetings to discuss monitoring results

Objective 6. Secure coordination between Range States.

Target 6.1: Effective coordination mechanisms are established and implemented.

Activity 6.1.1: Identify relevant implementing authorities and contact representatives in each range state.
Activity 6.1.2: Strengthen the role of CCCAO as a focal point for coordination
Activity 6.1.3: Establish and enhance information exchange mechanisms.
Activity 6.1.4: Disseminate best practice and lessons learned

Objective 7. Secure financial sustainability.

Target 7.1: Appropriate financial resources for Arabian Oryx programmes secured and allocated.

Activity 7.1.1: Identify all potential sources of finance for Arabian Oryx programs.
Activity 7.1.2: Promote the development and implementation of the Arabian Oryx Trust Fund.

5 IMPLEMENTATION

The purpose of this strategy is to help to design and implement coordinated, concrete conservation programmes. Implementation is the most important part of all conservation strategies. The challenge therefore is to translate the efforts and analyses that went into production of the strategy document into effective action on the ground.

This strategy provides guidance for the conservation of the Arabian Oryx at the overall range level. The objectives, targets and activities listed here refer to tasks that need to be addressed regionally or that require international co-operation. In most cases, however, these are most effectively implemented by range states because administration, implementing agencies, legal frameworks, protected area administration, and budgets operate primarily at national level. Therefore, National Action Plans for Arabian Oryx should be developed in each range state. These Action Plans should build upon the principles outlined in the strategy and refine the individual elements as appropriate. A template for production of National Arabian Oryx Action Plans is included in Appendix 2.

Regional coordination, dissemination of best practice and development of agreed regional guidelines on all aspects of oryx conservation are desirable and essential. Regular review and revision where necessary are integral elements of any plan. The workshop participants agreed that the CCCAO should take on the primary role for coordinating and monitoring implementation of this strategy, including the aspects referred to above.

IUCN/SSC's Antelope Specialist Group and Reintroduction Specialist Group are committed to provide continued support for the implementation and further development of the Arabian Oryx Conservation Strategy and the development of National Action Plans.

6 ACKNOWLEDGEMENTS

We would like to express our gratitude to H.E Mohammed Al Bawardi, H.E Majid Al Mansouri and Mr. Abdulnasser Al Shamsi of the Environment Agency – Abu Dhabi for hosting this workshop. Thanks to Dr. David Mallon, IUCN/SSC Antelope Specialist Group for facilitating the workshop and developing this report. Thanks to Dr. Andrew Spalton and Mr. Zafar-ul Islam for their helpful comments on the first draft, and to all the participants who attended the workshop.

We would also like to express our appreciation to Mr. Myyas Al Quarqaz, Mr. Osama Al Fakeer, Mr. Yasser Al Kharousi and the EAD Environmental Awareness Sector / Communications Department for revising, translating and publishing this document.

7 REFERENCES

1. Abu Jafer, M.Z. & Hays-Shahin, C. (1988) Re-introduction of the Arabian Oryx into Jordan. Pp. 35-40 in: A. Dixon and D. Jones, eds. Conservation and Biology of Desert Antelopes. London: Christopher Helm.

2. Al Quarqaz, M. and Kiwan, K. (2006) Arabian Oryx release program, Abu Dhabi Emirate, United Arab Emirates. Re-introduction News 25: 41-42.

3. Al-Kharousi, Y.H. (2006) Poaching of re-introduced Arabian Oryx in Oman: Will accession to CITES help? Re-introduction News 25: 23-25.

4. Ancrenaz, M., and Delhomme, A. (1997) Teeth eruption as a mean of age determination in captive Arabian Oryx Oryx leucoryx (Bovidae, Hippotraginae). Mammalia 61: 135-138.

5. Anon. (1952) Oryxes caught alive. Journal of Bombay Natural History Society 50: 186.

6. Asmodé, J.F. (1990) Food choice and digging behaviour of native Arabian Oryx reintroduced in their natural environment. Revue d'Ecologie (Terre at Vie) 45: 295-301.

7. Asmodé, J.F. and Khoja, A.R. (1989) Arabian Oryx captive breeding and reintroduction in Saudi Arabia. Pp. 109-125 in: U.S. Seal, K. Sausman & J. Mikolai, eds. CBSG aridland antelope workshop, San Antonio, Texas. Apple Valley, MN: IUCN/SSC/CBSG.

8. Carruthers, D. (1935) Arabian adventure to the great Nafud in quest of the oryx. London: Willoughby.

9. Chassot, P., Mésochina, P. and Ostrowski, S. (2005) Re-introduction of Arabian Oryx in the Kingdom of Saudi Arabia: up-date on population size in two protected areas. Re-introduction News 24: 17-19.

10. Corp, N., Spalton, A. and Gorman, M.L. (1998) The influence of rainfall on range in a female desert ungulate: the Arabian Oryx (Oryx leucoryx) in the Sultanate of Oman. Journal of Zoology 246: 369-377

11. Cribiu, E.P., Asmodé, J.F., Durand, V., Greth, A. and Anagariyah, S. (1990) Robertsonian chromosome polymorphism in the Arabian Oryx (Oryx leucoryx). Cytogenetics and Cell Genetics 54: 161-163.

12. Dolan, J.M. (1976) The Arabian Oryx Oryx leucoryx its destruction, captive history and propagation. International Zoo Yearbook 16: 230-239.

13. El Alqamy, H. (2006) Re-introduction of Arabian Oryx in Dubai Desert Conservation Reserve, Dubai, UAE. Re-introduction News 25: 22-23.

14. Flamand, J.R.B., Delhomme, A. and Ancrenaz, M. (1994) Hand-rearing the Arabian Oryx Oryx leucoryx at the National Wildlife Research Center, Saudi Arabia. International Zoo Yearbook 33: 269-274.

15. Forester, D.J. and Tear, T.H. (1995) Using GIS to model Arabian Oryx habitat quality and use: a preliminary analysis. Pp. 662-666 in: J.A. Bissonette and P.R. Krausman, eds. Integrating people and wildlife for a sustainable future. Proceedings of the First International Wildlife Management Congress. Bethesda, MD: The Wildlife Society.

16. Gillet, H. (1989) Diet of the Arabian Oryx Oryx leucoryx at the National Wildlife Research Centre, Taif. Pp. 327-334 in: A. Abuzinada, P. Goriup & I. Nader, eds. Wildlife Conservation and Development in Saudi Arabia. Riyadh: NCWCD. Publication No. 3.

17. Grenot, C.J. (1992) Ecophysiological characteristics of large herbivorous mammals in arid Africa and the Middle East. Journal of Arid Environments 23: 125-155.

18. Greth, A. and Schwede, G. (1993) The reintroduction programme for Arabian Oryx Oryx leucoryx in Saudi Arabia. International Zoo Yearbook 32: 73-80.

19. Greth, A.J. Flamand, J.R.B and Delhomme, A. (1994) An outbreak of tuberculosis in a captive herd of Arabian Oryx Oryx leucoryx. Veterinary Record 134: 165-167.

20. Greth, A., Gourreau, J.M., Vassart, M., Nquyen, B. Wyers, M. and Lefevre, P.C. (2002) Capripoxivirus disease in an Arabian Oryx (Oryx leucoryx) from Saudi Arabia. Journal of Wildlife Diseases 28: 295-300.

21. Grimwood, I.R. (1962) Operation Oryx. Oryx 6: 308-334.

22. Grimwood, I.R. (1967) Operation Oryx: three stages of captive breeding. Oryx 9: 110-122.

23. Harding, L E., Abu-Eid, O.F., Hamidan, N., and Sha'lan, A. (2007) Reintroduction of the Arabian Oryx (Oryx leucoryx) in Jordan. Pp. 1-21 in: A. Al-Johany, ed. The Arabian Oryx in the Arabian Peninsula. Special Publication on the convening of an international conference of the Arabian Oryx in the Arabian Peninsula; along with the 23rd meeting of the Saudi Biological Society 21-23 April 2007. Riyadh.

24. Harrison, D.L. and Bates, P.J.J. (1991) The Mammals of Arabia. Second edition. Sevenoaks, UK: Harrison Zoological Museum.

25. Hatough, A.M. and Al-Eisawi, D.M. (1988) The Arabian Oryx in Jordan. Journal of Arid Environments 14: 291-300.

26. Hatough-Bouran, A. and Disi, A.M. (1995) The impact of development and population growth on ecological systems: Global and local issues. Dirasat 22A: 70-84.

27. Henderson, D.S. (1974) The Arabian Oryx: a desert tragedy. National Parks and Conservation Magazine 48: 15-21.

28. Homan, W.G. (1988) The establishment of the World Herd. Pp. 9-13 in: D. Jones and A. Dixon, eds. Conservation and biology of desert antelopes. London: Christopher Helm.

29. Islam, M. Z., Boug, A., Anagariyah, S., Ismail, K., Robinson, E.R. and Mohammed, O.B. (2007) Catastrophic die-off of reintroduced animals in Mahazat as-Sayd Protected Area in arid central Saudi Arabia. Riyadh: National Wildlife Research Center, King Khalid Wildlife Research Center and National Commission for Wildlife Conservation and Development, Saudi Arabia. Pp. 1-60.

30. Ismail, K. (2006) Report on the effect of drought in Mahazat as-Sayd Protected Area. Unpublished report. Taif: NWRC (in Arabic).

31. IUCN (1998) IUCN Guidelines for Re-introduction. Gland, Switzerland and Cambridge, UK: IUCN/SSC Re-introduction Specialist Group.

32. Jones, D.M. (1988) The Arabian Oryx in captivity with particular reference to the herds in Arabia. Pp. 47-57 in: D. Jones and A. Dixon, eds. Conservation and biology of desert antelopes. London: Christopher Helm.

33. Jones, M.L. (1993) Longevity of ungulates in captivity. International Zoo Year Book 32: 159-169.

34. Jungius, H. (1985) The Arabian Oryx: its distribution and former habitat in Oman and its reintroduction. Journal of Oman Studies 8: 49-64.

35. Kingswood, S.C., Cowan, P.J. and Clayton, D.A. 2001. Kuwait. Pp. 84-87 in: D.P. Mallon and S.C. Kingswood, compilers. Antelopes. Part 4: North Africa, the Middle East, and Asia. Global Survey and Regional Action Plans. Gland, Switzerland and Cambridge, UK: IUCN. SSC Antelope Specialist Group.

36. Mace, G.M. (1989) Genetic status of Arabian Oryx in Oman. In: Arabian Oryx workshop: strategies and management for continuing reintroduction of the species into the wild. Muscat, Oman: Office of the Adviser for Conservation of the Environment, Diwan of Royal Court.

37. Marshall, T.C. and Spalton, J.A. (2000) Simultaneous inbreeding and outbreeding depression in reintroduced Arabian Oryx. Animal Conservation 3: 241-248

38. Marshall, T.C., Coltman, D.W., Pemberton, J.M., Slate, J., Spalton, J.A., Guinness, F.E., Smith, J.A., Pilkington, J.G. and Clutton-Brock, T.H. (2002) Estimating the prevalence of inbreeding from pedigrees. Proceedings of the Royal Society of London, B. 269: 1533-1539.

39. Marshall, T.C., Sunnucks, P., Spalton, J.A., Greth, A. and Pemberton, J.M. (1999) Use of genetic data for conservation management: the case of the Arabian Oryx. Animal Conservation 2: 269-278.

40. Mésochina, P., Bedin, E. and Ostrowski, S. (2003a) Arabian Oryx re-introduction in ‘Uruq bani Ma’arid, Saudi Arabia: update with emphasis on mortality. Re-introduction News 22: 38-39.

41. Mésochina, P., Bedin, E. and Ostrowski, S. (2003b) Reintroduction of antelopes into areas: lessons learnt from the oryx in Saudi Arabia. C.R. Biologies 326: S158-S165.

42. Ostrowski, S. and Anajariyah, S. (2003) Middle East Arabian Oryx disease survey. Unpublished report. Taif, NCWCD/NWRC.

43. Ostrowski, S. and Bedin, E. (2001) Arabian Oryx re-introduction in 'Uruq Bani Ma'arid, Saudi Arabia: summary and update: January 2001. Re-introduction News 20: 16-17.

44. Ostrowski, S. and Mésochina, P. (2005) A proposed Action Plan for Arabian Oryx herds under the custody of NCWCD 2005-2008. Unpublished report. Taif: NWRC.

45. Ostrowski, S. and Williams, J.B. (2001) Wild ungulate management in protected areas. Recommendation of a meeting held at the NWRC, 24-25 June 2001. Unpublished report. Taif: NCWCD/NWRC.

46. Ostrowski, S. and Williams, J.B. (2006) Physiological acclimation of a desert antelope, Arabian Oryx (Oryx leucoryx), to long-term food and water restriction. Journal of Comparative Physiology B 176: 191-201

47. Ostrowski, S., Anagariya, S., Kamp, E.M. and Bedin, E. (2002) Isolation of Brucella melitensis from an Arabian Oryx (Oryx leucoryx). Veterinary Record 150: 186-188.

48. Ostrowski, S., Bedin, E., Lenain, D.M. and Abuzinada, A.H. 1998. Ten years of Arabian Oryx conservation in Saudi Arabia – achievements and regional perspectives. Oryx 32: 209-222.

49. Ostrowski, S., Williams, J. and Ismail, K. (2003) Heterothermia and the water economy of free-living Arabian Oryx. Journal of Experimental Biology 206: 1471-1478.

50. Ostrowski, S., Williams, J.B., Bedin, E. and Ismail, K. (2002) Water influx and food consumption of free-living oryxes Oryx leucoryx in the Arabian desert in summer. Journal of Mammalogy 83: 665-673.

51. Ostrowski, S., Williams, J.B., Blanvillain, C., Mésochina, P., Ismail, K. and Schwarzenberger, F. (2005) Monitoring reproductive steroids in feces of Arabian Oryx: towards a non-invasive method to predict reproductive status in the wild. Wildlife Society Bulletin 33: 965-973.

52. Petit, T. and Poilane, J.F. (1987) Morphine like drugs utilised for capture and anesthesia of the Arabian Oryx (Oryx leucoryx). Pp. 7-17 in: Quarterly Report Winter 1987. Taif: NWRC.

53. Philby, H.St J.B. (1933) The Empty Quarter. London: Constable.

54. Seddon, P. and Ismail, K. (2002) Influence of ambient temperature on diurnal activity of Arabian Oryx: implications for reintroduction site selection. Oryx 36: 50-55.

55. Seddon, P., Ancrenaz, M., Ostrowski, S., and Magin, C. (1996) Arabian Oryx management plan. First draft. Riyadh: NCWCD.

56. Shobrak, M. (2007) Evaluation of the Arabian Oryx reintroduction programmes in range states: lessons to learn. Saudi Journal of Biological Sciences 14: 125-138 (in Arabic, English abstract).

57. Spalton, J.A. (1992) The Arabian Oryx (Oryx leucoryx) re-introduction project in Oman: 10 years on. Pp. 342-347 in: F. Spitz, G. Janeau, G. Gonzalez and S. Aulagnier, eds. Ungulates 91. Paris: SFEPM.

58. Spalton, J.A. (1993) A brief history of the reintroduction of the Arabian Oryx (Oryx leucoryx) into Oman 1980-1992. International Zoo Year Book 32: 81-90.

59. Spalton, J.A. (1995) Effects of rainfall on the reproduction and mortality of the Arabian Oryx (Oryx leucoryx Pallas) in the Sultanate of Oman. PhD Thesis, University of Aberdeen.

60. Spalton, J.A. (1999) The food supply of Arabian Oryx (Oryx leucoryx) in the desert of Oman. Journal of Zoology 248: 433-441.

61. Spalton, J.A., Lawrence, M.W. and Brend, S.A. (1999) Arabian Oryx reintroduction in Oman: successes and setbacks. Oryx 33: 168-175.

62. Stanley Price, M.R. 1989. Animal reintroduction: the Arabian Oryx in Oman. Cambridge: Cambridge University Press.

63. Stanley Price, M.R., al-Harthy, A. bin H. and Whitcombe, R.P. (1988) Fog moisture and its ecological effects in Oman. Pp. 69-88 in: E.E. Whitehead, E.F. Hutchinson, B.N. Timmermann and R.G. Varady, eds. Arid lands: today and tomorrow. Tuscon, Arizona: Westview Press.

64. Stewart, D.R.M. (1963) The Arabian Oryx (Oryx leucoryx Pallas). East African Wildlife Journal 2: 103-118.

65. Strauss, W.M. (2002) Towards the effective management of the Arabian Oryx Oryx leucoryx in the Kingdom of Saudi Arabia. Zeitschrift für Jagdwissenschaft (Supplement): 7-16.

66. Strauss, M.W. (2003) An ecological study of reintroduced Arabian Oryx Oryx leucoryx in 'Uruq Bani Ma'arid Protected Area of Saudi Arabia. MSc. thesis. University of Pretoria.

67. Strauss, M. (2007a) The Arabian Oryx re-introduction program in Saudi Arabia. Re-Introduction News 26: 51-53.

68. Strauss, M.W. (2007b) Arabian Oryx reintroduction into its natural habitats. Pp 59-78 in: A. Al-Johany, ed. The Arabian Oryx in the Arabian Peninsula. Special Publication on the convening of International conference of the Arabian Oryx in the Arabian Peninsula. Along with the 23rd meeting of the Saudi Biological Society 21-23 April 2007, Riyadh.

69. Talbot, L. M. (1960) A look at threatened species. Oryx 5: 240-247.

70. Tear, T.H. (1989) Present status of the Arabian Oryx on the Jiddat al-Harasis. In: Arabian Oryx workshop: strategies and management for continuing reintroduction of the species into the wild. Muscat, Oman: Office of the Adviser for Conservation of the Environment, Diwan of Royal Court.

71. Tear, T.H. (1992) Range use patterns and the development of a natural grazing system in reintroduced Arabian Oryx (Oryx leucoryx) in the Sultanate of Oman. Masters thesis. Moscow, Idaho.

72. Tear, T.H. (1994) Foraging strategies, social system, and viability analysis: the development of a reintroduced Arabian Oryx population. PhD thesis. Moscow, Idaho.

73. Tear, T.H. (1995) The development of a natural grazing system in reintroduced Arabian Oryx in Oman. Pp. 684-689 in: J.A. Bissonette and P.R. Krausman, eds. Integrating people and wildlife for a sustainable future. Proceedings of the First International Wildlife Management Congress. Bethesda, MD: The Wildlife Society.

74. Tear, T.H. and Ables, E.D. (1999) Social system development and variability in a reintroduced Arabian Oryx population. Biological Conservation 89: 199-207

75. Tear, T.H. and Forester, D. (1992) Role of social theory in reintroduction planning: a case study of the Arabian Oryx in Oman. Soc. Nat.Research 5: 359-374.

76. Tear, T.H., and Stanley Price, M.R. (1991) Rehabilitating desert ecosystems through reintroduction of ungulates: The experience of the Arabian Oryx. Pp. 219-231 in: J.A. McNeely and V.M. Neronov, eds. Mammals in the Palaearctic desert: Status and trends in the Sahara-Gobian Region. Proceedings from the Fifth International Theriological Congress, Rome, Italy, 22-29 August 1989. Moscow: Russian Academy of Sciences.

77. Tear, T.H., Mosley, J. and Ables, E. (1998) Landscape-scale foraging decisions by reintroduced Arabian Oryx. Journal of Wildlife Management 61: 1142-1154.

78. Thesiger, W. (1959) Arabian Sands. London: Longmans, Green & Co. Ltd.

79. Thomas, B. (1932) Arabian Felix: across the Empty Quarter of Arabia. London: Jonathan Cape.

80. Treydte, A.C., Williams, J.B., Bedin, E., Ostrowski, S., Seddon, P., Marschall, E.A., Waite, T.A. and Ismail, K. (2001) In search of the optimal management strategy for Arabian Oryx. Animal Conservation 4: 239-249.

81. Turkowski, F.J. and Mohney, G.C. (1971) History, management and behavior of the Phoenix zoo Arabian Oryx herd, 1964-1971. Arizona Zoological. Society Bulletin 2: 1-36.

82. Williams, J.B., Ostrowski, S., Bedin, E. and Ismail, K. (2001) Seasonal variation in energy expenditure, water flux, and food consumption of Arabian Oryx. Journal of Experimental Biology 204: 2301-2311.

83. Woodford, M.H. (1989) Veterinary implications for the reintroduction of the Arabian Oryx in Arabia. In: Arabian Oryx workshop: strategies and management for continuing reintroduction of the species into the wild. Muscat, Oman: Office of the Adviser for Conservation of the Environment, Diwan of Royal Court.

Part 2. O.I.E. Scientific and Technical Review.

8 APPENDICES

8.1 Arabian Oryx National Action Plan: Template.

This Action Plan proposes that Arabian Oryx Range States prepare National Action Plans on their populations of the Arabian Oryx.
To standardize the format of national action plans it is recommended to structure the action plans as follows:

1. Current Status of the Arabian Oryx.

2. Problems/Threats facing the Arabian Oryx at the National level.

3. Agencies/Ministries responsible for Arabian Oryx conservation.

4. Contact point[s].

5. Relevant Legislation protecting Arabian Oryx, with dates, etc.

6. Proposed conservation actions (refer to the objectives and goals of the Regional Strategy where relevant).

8.2 List of Workshop Delegates

CONTACT DETAILS	ORGANIZATION	NAME
Syria		
Tel.: 00963932288532 Fax: 00963 (11) 444 7608 maanabli@yahoo.com	GCEA	Maan Al Abli
Tel.: 0096333096360 Fax: 00963 (11) 444 7608 omaymarihan@yahoo.com	GCEA	Omayma Rihan
Sultanate of Oman		
Tel.: + 968 24693536 Fax: + 968 24693883 acedrc@omantel.net.om	Office of the Adviser for Conservation of the Environment Diwan of Royal Court	Yaser Bin Hamdan Al Kharousi
Tel.: + 968 24693536 Fax: + 968 24693883 acedrc@omantel.net.om	Office of the Adviser for Conservation of the Environment Diwan of Royal Court	Salah Saaied Al Mahdori
Kingdom of Saudi Arabia		
Tel.: 00966504714428 anagariyah@nwrc-sa.org	NCWCD	Dr. Saoud Anagariyah
Jordan		
Tel.: +00962796616699 Fax: +96232013382 kabdallat@aseza.jo	Wadi Rum Protected Area ASEZA	Khalil Abdallat
Tel.: 00962799444291 Fax: 009627992032586 jzaidein@aseza.jo	Wadi Rum Protected Area ASEZA	Jamal Al zaidaneen
Tel.: +962 6 533 79 31 Fax: +962 (6) 534 74 11 nashat@rscn.org.jo	Royal Society for the Conservation of Nature	Nashat Hamidan
Tel.: +962 6 533 79 31 Fax: +962 (6) 534 74 11 mohammedyousef@rscn.org.jo	Royal Society for the Conservation of Nature	Mohammad Yousef
Kingdom of Bahrain		
Tel.:00976-39196108 Fax: 00973-17836117 mubarak-aldosary@hotmail.com	General Authority for the Protection of Wildlife and Marine Resources	Mubarak Al Dosari
Tel.: 00973-39457775 Fax: 00973-17836074 Dr.alawadhi@hotmail.com	General Authority for the Protection of Wildlife and Marine Resources	Dr .Adil Awad

Qatar		
Tel.: 00974-5005558 Fax: +974 4718439 bmarri@qatarenv.org.qa	Higher Council for Environment and Protected Areas	Mohammad Al Marri
United Arab Emirates		
Tel.: 0097126934606 malmansouri@ead.ae	EAD	H.E Majid Al Mansouri
Tel.: 0097126934643 analshamsi@ead.ae	EAD	Abdulnasser Al Shamsi
Tel.: 0097126934694 ksuwaidi@ead.ae	EAD	Khalfan Al Suwaidi
Tel.: 00971 (050) 3553755 aaldahri@ead.ae	EAD	Ahmad Al Dhaheri
Tel.: 00971 (050)4613229 halalqami@ead.ae	EAD	Hosam Al Al Qami
Tel.: +97126934780 aalsuwaidi@ead.ae	EAD	Ahmad Al Sewaid
Tel.: 00971-26934646 malquarqaz@ead.ae	EAD	Myyas Al Quarqaz

Tel.: 00971 (050) 455770 Fax: 00971 (04)8098710 greg.simkins@emirates.com	DDCR	Gregory Simkins
Tel.: 06 5311212 Fax: 06 5311156 breeding@epaa-shj.gov.ae	EPAA	Paul Vercammen
Tel.: 00971 (050) 6421869 flaunay@ead.ae	EWS-WWF	Dr. Frederic Launay
Tel.: 00971 (02) 693 4650 Fax: 00971 (02) 681 0008 psoorae@ead.ae	RSG/EAD	Pritpal Soorae
ctourenq@wwfuae.ae	EWS - WWF	Christophe Tourenq
Tel: 00971 (050) 5524911 Fax: 00971 (04) 809810 gavin.nel@emirates.com	DDCR	Gavin Nel
Tel.: 00971 3 7820809 Fax: 00971 37820809 mark.craig@alain-zoo.ae	Al Ain Zoo	Dr .Mark Craig
Tel.: 00971 3 7820809 Fax: 00971 37820809 mark.craig@alain-zoo.ae	Al Ain Zoo	Dr. Mohammad Saad

Tel.: 0097150612952 Fax: 0097126655671 mvsee36@yahoo.com	Crown Prince of Abu Dhabi Court	Jacob Mwanzia
Yemen		
Office Tel.: 00967 1 473867 Mobile: 00967 777292093 rubatbaeshen@yahoo.com	Environment Protection Authority Sana>a	Omer Baeshen
Tel.: 00967777911596 Fax: 009671214075 karimnasher@yahoo.com	Environment Protection Authority Sana'a	Dr .Abdul Kareem Nashir
Tel: Fax: hhab10@yahoo.com	Wadi Hadramout Development Fund	Ali Abdul Kader
IUCN /SSC		
Tel.: 00441457853560 Fax: 00441457852578 d.mallon@zoo.co.uk	IUCN - ASG	sDr. David Mallon

8.3 List of Range State Member Agencies

UNITED ARAB EMIRATES

Environment Agency – Abu Dhabi
P.O. Box 45553
Abu Dhabi, UAE
Tel.: +971 2 4454777
Fax: +971 2 4997250
e-mail : customerservice@ead.ae

Environment Protection and Protected Areas Authority
P.O. Box 101
Sharjah, UAE
Tel.: +971 6 53 1 1419
Fax: +971 6 5519855
email: epaa@emirates.net.ae

SULTANATE OF OMAN

Office of the Adviser for Conservation of the Environment
Diwan of Royal Court
Muscat 113, Oman

Tel.: + 968 2 4693537
Fax: + 968 24693883
e-mail: acedrc@omantel.net.om

JORDAN

The Royal Society for the Conservation of Nature
P.O. Box 6354
Amman 11183, Jordan

Tel.: +96265337931/2
Fax: +962 6 5347411
e-mail: rscn@rscn.org.jo

SAUDI ARABIA

NCWCD
P.O. Box 61681
Riyadh 11575, Saudi Arabia

Tel.: +966 1 441 8700
Fax: +966 1 4418447
e-mail: info@ncwcd-sa.org

QATAR

Higher Council for Environment and Protected Areas
P.O. Box 20380
Doha, Qatar

Tel.: +974 719 578, +974 4437171
Fax: +974 4415246

BAHRAIN

National Agency for Wildlife Conservation
P.O. Box 28690
Bahrain

Tel.: +973 836116
Fax: +973 836117
e-mail: bncftpw@batelco.com.bh