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

Stanley Price, M.R. 1989. Animal reintroductions: the Arabian oryx in Oman. *Cambridge University Press: Cambridge.*

Stanley Price, M.R. & Soorae, P.S. 2003. Reintroductions: whence and whither? *Int. Zoo Yb., 38, 61-75.*

***Contributed by Andrew Spalton, Adviser for Conservation of the Environment, Diwan of Royal Court, Muscat 113, Oman, e-mail:* spalt@omantel.net.om**

Arabian oryx re-introduction into Mahazat as-Sayd protected area – Saudi Arabia: from rehabilitation to population management

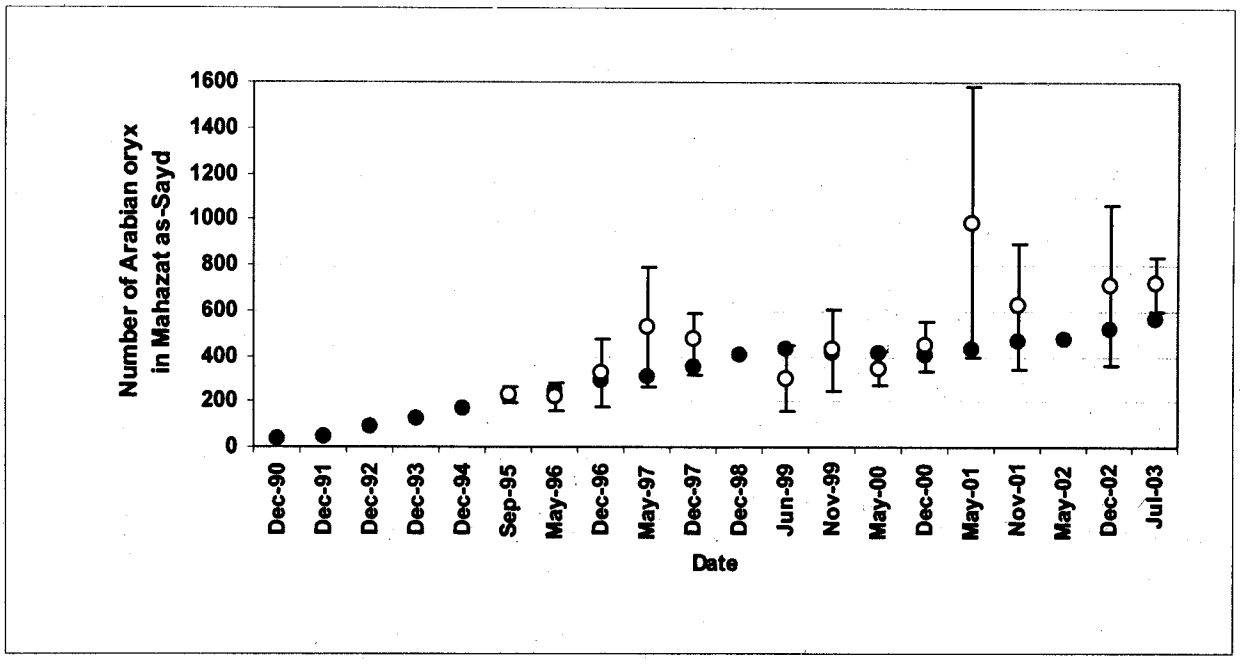
The Arabian oryx (*Oryx leucoryx*) formerly occurred throughout the Arabian Peninsula deserts and was extirpated from the wild by hunting in the early 1970's (Henderson, 1974). In 1986 an intensive captive-breeding program was started at the National Wildlife Research Center (NWRC), Taif, Saudi Arabia. The first site considered for the re-introduction of oryx in Saudi Arabia was the Mahazat as-Sayd (Ostrowski *et al.*, 1998). The area consisted of a 2,244-km^2 tract of flat, arid steppe desert in west-central Saudi Arabia (28°15'N, 41°40'E). After being designated as a protected nature reserve in 1988, Mahazat as-Sayd was surrounded by a fence in 1989 to exclude domestic livestock. Other than temporary pools after sporadic rain (average 90-100 mm per year), the area provides no drinking water for oryx.

Between 1990 and 1993, 72 Arabian oryx from the NWRC and foreign collections (e.g. San Diego Wild Animal Park, USA) were moved to the reserve and held within a 2 km^2 enclosure, and then released into the protected area. The re-introduced animals survived without food and water supplementation. During 1990-1993, a team of rangers under the supervision of the reserve's manager tracked and located oryx daily. As the population grew and animals dispersed into many small herds it became increasingly difficult to account for all of the oryx each day. Since May 1995 regular transect surveys have been carried out in the reserve and population trends have been documented in the protected area (Seddon *et al.*, 2003). Between 1990 and 1997, the population increased steadily up to about 400 individuals (see Figure 1 below). Then in 1998 and 1999, because of severe drought conditions, the population leveled off around 350-400 individuals. Between 2001 and 2003 good rainfalls, and resulting good forage conditions allowed the population to recover and increase to an estimated 720 individuals (95% confidence interval: 600–840) in July 2003.

Necessary management of the rehabilitated population

Although the ecological capacity of a protected area is an issue particularly difficult to address in temperate countries, it becomes a supreme challenge in arid environments where spatial and temporal heterogeneity of the range habitat scales in meters and rarely in kilometers. Acknowledging this difficulty we have designed a demographic model for the Arabian oryx in Mahazat as-Sayd, using satellite

Figure 1. Growth of the Mahazat as-Sayd oryx population between 1990 and 2003. Two estimates are presented (●: ranger's estimate based on known births and deaths; 0: Mark re-sighting estimate).



imagery, range quality assessment, eco-physiological data and population demography data (Treydte *et al.*, 2001). The model predicts that the maximal carrying capacity for the protected area would be 800-850 oryx. Above this threshold the population is likely to undergo significant density-dependant mortality during periods of under-average forage conditions. The model also evaluates the probability of extinction (frequency with which 100 initial populations fall to zero within 100 years) of the Mahazat as-Sayd oryx population under various management strategies. The probability of extinction was high when no management was applied to the population (probability of extinction varied between 0.3 and 0.92 according to combination of assumptions) whereas removing every year all oryx above 70% of carrying capacity provided the lowest probability of extinction, and the lowest population size variation whatever was the combination of assumptions. A more readily applicable management option; removing annually 15% of the current population, would also provide a low probability of extinction, despite wide fluctuations in population size.

Management decisions are simple in their principles but relatively complex to implement on the ground. The method of "removal" of oryx must be discussed (either physically through culling or capture and emigration or virtually through sterilization procedures) and funding appended according to management methods required. Whatever the management option applied, human intervention seems ineluctable to maintain the long-term viability of the Arabian oryx population re-introduced in Mahazat as-Sayd. Rehabilitation of the Arabian oryx in Mahazat as-Sayd Protected Area has been completed in a decade, however nowadays the new challenge concerns its long-term survival.

References

Henderson, D. S. 1974. Were they the last Arabian oryx? *Oryx, 12, 347-350.*

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

Seddon, P. J., Ismail, K., Shobrak, M., Ostrowski, S. & Magin, C. 2003. Using mark-recapture and distance sampling methods to estimate the population size of a desert ungulate, the Arabian oryx. *Oryx 37(3) (in press).*

Treydte A. C., Williams J.B., Bedin E., Ostrowski S., Seddon P.J., Marschall E.A., Waite T.A. & Ismail K. (2001). In Search of optimal management strategy for Arabian oryx. *Animal Conservation, 4, 239-249.*

***Contributed by Pascal Mésochina, Stéphane Ostrowski & Khairi Ismail, National Wildlife Research Center, Taif, Saudi Arabia, e-mail :* Mesochina@nwrc-sa.org**

Arabian oryx monitoring at 'Uruq Bani Ma'arid protected area, Saudi Arabia: population size estimate

The 'Uruq Bani Ma'arid protected area occupies 12,500 km^2 of the western edge of the Rub' al-Khali desert, the largest sand sea in the world, located in the south of the Arabian Peninsula. The protected area extends from the southern extremity of the Jurassic escarpment of Tuwayq in the west, through a limestone plateau incised with vegetated wadis and gullies and towards large longitudinal dune areas in the east. From March 1995 to July 2002, a total of 149 Arabian oryx (*Oryx leucoryx*) were re-introduced into the 'Uruq Bani Ma'arid protected area (Mésochina *et al.*, 2003). Some were wild-born animals from the Mahazat as-Sayd protected area, Saudi Arabia (see update on page 29), but most were captive-born from the National Wildlife Research Center, Taif, Saudi Arabia. Monitoring of oryx range use in the protected area have shown a seasonal pattern of movement, animals retrieving to the western escarpment plateau in the hot season and returning eastwards into the sands in cooler months (Wacher, 1998). Since 2001 we have been using the fact that during summer the oryx population ranges over a relatively small area (i.e. 2,500 km^2) where trees and overhanging rocks offer presumably enough shelter they require to survive the hot season, to carry out population size estimates. We employ a mark/re-sighting method using the Lincoln-Petersen index calculation technique. This technique has proved efficient in estimating oryx population sizes in the Mahazat as-Sayd protected area (Seddon *et al.*, 2003).

In August 2003 we estimated the Arabian oryx population in the western edge of 'Uruq Bani Ma'arid at 203 individuals ..

The "total count" was carried out on 20th, 21st and 22nd August 2003. The protected area was divided into 13 sectors of approximately equal size, based on topography and limited by major tracks, hills, dunes, all readily observed permanent features. We counted during three consecutive mornings and one afternoon. Each count session was dedicated to a separate area. No set routes were defined and there was no time limits set for the census in each area. Surveying teams were composed of two to three observers equipped with binoculars and a GPS unit programed to record the track followed, in order to quantitatively assess the area covered. Observations were made during the week prior to the count showed that the oryx rarely migrated between sectors, suggesting that the probability to re-count the same individuals between days was low. In August 2003 we estimated the Arabian oryx population in the western edge of 'Uruq Bani Ma'arid at 203 individuals with a 95% Confidence Interval (CI) of 169–237. When excluding immature individuals (<18-24 month-old), the adult population was estimated at 157 oryx, 95% CI = 133–181.

The Lincoln-Petersen index estimations suffer a major flaw