

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.

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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 km² 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

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).

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

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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 km²) where trees and overhanging rocks offer presumably enough shelter they require to survive the hot

when the number of marked individuals in the population is inaccurately known. For this reason, up-dating the number of marked oryx (collared) present in the protected area and increasing the proportion of marked animals in the population have been two important management / monitoring activities during the previous months. The population estimate we provide is derived from a number of marked animals recorded for the 12 months prior to the count, a reasonably accurate estimation of the total number of marked oryx present in the surveyed area during the census. Although 149 oryx have been re-introduced into the protected area, a number of them have died due to inefficient adjustment to the new environment, starvation during the 1999-2000 drought period, poaching, and intra-specific fights. We estimate that 75 (50%) of them have survived. The oryx population at 'Uruq Bani Ma'arid is therefore composed of 60% wild-born individuals, a great asset to the population if one assumes that wild-born individuals are better adjusted to the environment than captive-bred oryx and that their capacity to survive harsh conditions is presumably optimized. Population estimates were consistent with results of routine monitoring carried out throughout 2003. When comparing with previous population estimates carried out respectively in July 2001 and August 2002, the present estimate was slightly higher than in 2002 and similar to results of 2001. However, the relatively large 95%CI (i.e. 169 - 237) observed in 2003 compared to 2001 (i.e. 182 - 216) and 2002 (i.e. 164 - 202) limits our predications of population trends.

To the best of our knowledge the population has not suffered a significant decrease or increase since August 2002. The reasons for a lack of increase of the population could be several, ranging from an underestimation of death rate (undetected poaching or environmental stress deaths), the existence of an emigration trend, the presence of wild-born oryx in non surveyed areas, a population that has already reached a demographic equilibrium with the environment, a positive but slow growth rate difficult to demonstrate on the short term. Many more years of monitoring might be necessary to clarify this demographic issue.

References

- Mésochina, P., E. Bedin, & S. Ostrowski. 2003. Arabian oryx re-introduction in 'Uruq Bani Ma'arid, Saudi Arabia: update with emphasis on mortality. *Re-introduction News*, 22, 38-39.
- Seddon, P. J., K. Ismail, M. Shobrak, S. Ostrowski & C. Magin. 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*.
- Wacher, T. 1998. Oryx monitoring at Uruq Bani Ma'arid, Saudi Arabia: 1997 progress report.

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Re-introduction of black rhino to Zambia

Five black rhino (*Diceros bicornis minor*) were re-introduced into Zambia's North Luangwa National Park (NLNP) on 28th May 2003. The status of black rhino in Zambia prior to this re-introduction was 'Presumed Extinct', with the last confirmed sighting of an animal in the early 1990's. In historical times Zambia was one of the black rhino's most important range states, and the Luangwa Valley, with an estimated population of up to 12,000 animals in the early 1970's, one of its strongholds in the country. The Frankfurt Zoological Society (FZS) has been supporting the Zambia Wildlife Authority (ZAWA), in the management and conservation of North Luangwa National Park since 1986, through its North Luangwa Conservation Program (NLCP). This long-term partnership has resulted in effective security and management systems being in place and the re-introduction of black rhino was a logical next step in conservation activities in the park. A positive evaluation of the habitat and security of NLNP by the Southern African Development Community (SADC) Regional Program for Rhino Conservation in 2001 set the stage and a formal proposal by ZAWA and NLCP was presented at the IUCN/SSC Rhino Specialist Group meeting in May 2002.

Release site

An area in the central area of the park, straddling the Lubonga River, was chosen as the site for the sanctuary in which the re-introduced rhinos would be released. The site's location was based on historical distribution data for black rhino in NLNP, as well as security considerations. A low-impact, 4-strand electrified fence was erected to contain the rhino in this 55 km² area, while allowing for relative freedom

of movement for other animals. Additional ZAWA wildlife police officers were seconded to the area, and received extra training to deal with rhino security.

Release

In an agreement mediated by FZS, South African National Parks donated 5 animals to the Zambia Wildlife Authority in exchange for two zoo-born black rhino calves from Frankfurt Zoo. The animals destined for Zambia were captured in Marakele National Park and Kruger National Park in March of this year, and the two males and three females were flown to North Luangwa National Park just over two months later. During their time in the bomas in NLNP, they were outfitted with radio transmitters in their horns, and received a trypanosomiasis inoculation, active for three months, to ease their introduction into a tsetse fly area. Tsetse targets and traps were also deployed at a low density throughout the sanctuary area, and at a high density around the boma site to initially reduce the tsetse population to allow the animals time to develop resistance to the tsetse parasite.

Post-release monitoring

The animals were released into the wider sanctuary area from their bomas after a period ranging from 2 ½ to 4 weeks, and have settled down well and none have broken through the perimeter fence. Their movements were predominantly monitored by plane for the first 6 weeks after release to keep disturbance to a minimum, although monitoring by foot patrol will become more important in the coming months. Data on the animals and their movements are being entered into the WildB database, developed by