



Re-introducing captive-bred Arabian oryx, *Oryx leucoryx*, and sand gazelle, *Gazella subguttarosa marica*, in Jordan

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Cover illustration: captive breeding pens for Dorcas' and sand gazelles

September, 2002

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INTRODUCTION

Arabian oryx have been extinct in the wild in Jordan since about 1945¹. Sand gazelles are apparently not extinct, but nearly so. In a 1996-1997 survey of mammal distribution and occurrence in the eastern desert, Dunstone and Scott (1997)² observed just one sand gazelle in the center of their former range.

The Shaumari Nature Reserve in eastern Jordan was created in 1972 to serve as a captive-breeding facility with the goal to re-introduce extirpated species back into the wild Bauman (1979)³ Initially, the principal species concerned were the Arabian oryx, Arabian [sand] gazelle and Dorcas' gazelle (*Gazella dorcas*).

During the 1970s and 1980s, the Hashemite Kingdom of Jordan created a number of nature reserves, both to protect extant species and to receive re-introduced animals from the captive breeding facility. By then the re-introduction program had been expanded to include Nubian ibex (*Capra [ibex] nubiana*), roe deer (*Capriolus capreolus*), fallow deer (*Dama dama*) and onager (*Equus onager*) (Hatough-Bouran and Disi (1991).⁴

During the 1980s the government in cooperation with Bedouin herders, was making major strides in grazing management and in wildlife management on rangelands. The Hammad Basin Development Programme was initiated in 1987. A system of rotating grazing reserves was being instituted in which grazing would be permitted until the range began to show signs of stress and then would be not permitted for a period of years, allowing it to recover. Meanwhile, wildlife reserves were being established that would be permanent, to allow more structurally and biologically diverse habitats to develop. Unfortunately, disease outbreaks among some of the captive ungulates reduced productivity. There were other problems as well, and overall, success was mixed. Of all the species obtained for breeding, only the oryx and ibex have prospered sufficiently to permit re-introduction into the wild. This paper reviews the status of the re-introduction program and its prospects for the future.



METHODS

Data on oryx were obtained from the RSCN in the form of a log of each animal that was brought to or born at the Shaumari Wildlife Reserve. Data on Gazelles and other species was from the literature as referenced. The author visited Shaumari on a number of occasions and the ibex breeding facility at Wadi Mujib once during July-September, 2002.

The population model is a density-dependent wildlife population growth model developed by the author and implemented in an Excel™ spreadsheet. The model takes the initial growth rate, starting population and maximum population as input and calculates the growth rate and population at time intervals from T=1 to T=n. The annual growth rate decreases as the ratio of the previous year's population to the hypothetical maximum population at carrying capacity.

RESULTS

Captive-breeding program history

The RSCN began planning to re-introduce extinct and nearly extinct wildlife species in 1966 and began with the establishment of Shaumari Nature Reserve in 1972 to serve as a captive breeding facility. Later another captive breeding facility for Nubian ibex was established at Wadi Mujib and one for roe deer at Ajloun Reserve.

Figure 1 shows the progressive establishment of grazing reserves, and Figure 2 shows the establishment of nature reserves. In Figure 2, the last two points on the graph, proposed nature reserves at Wadi Rajil and Ghadr Burqu, were in the process of being established in 1990 when a large influx of livestock into the country caused severe overgrazing of these areas. As a result, these plans were deferred.

At about the same time, during 1990-1991, disease outbreaks among the captive ungulates at Shaumari seriously affected the gazelle herd, from which it has still not recovered.

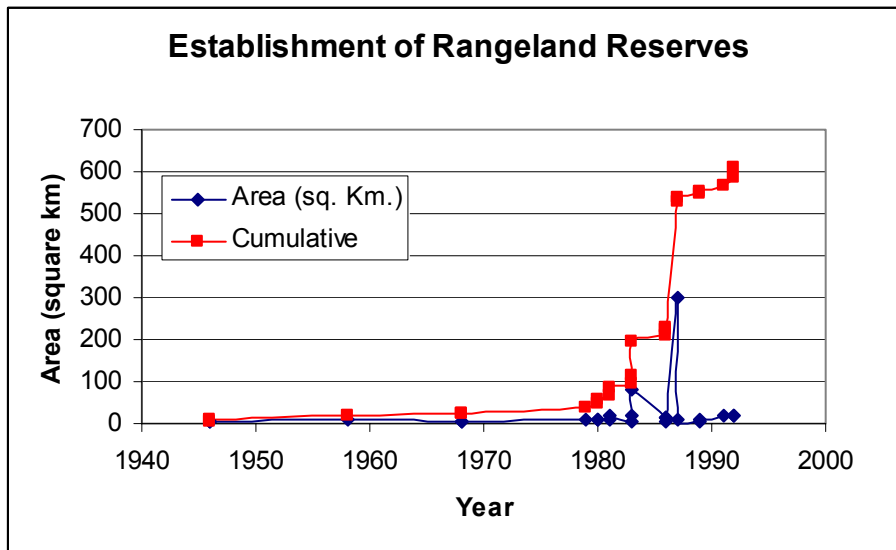


Figure 1. Trends in establishment of range reserves in Jordan.

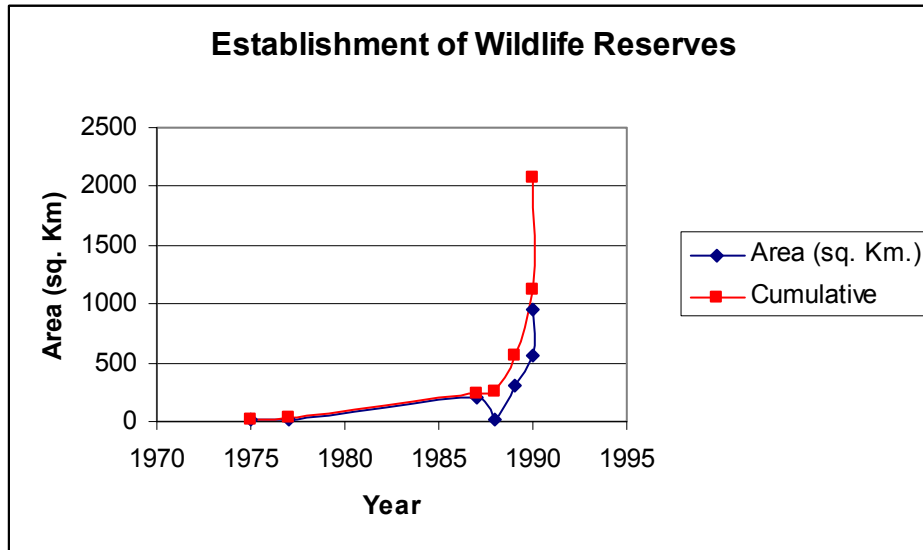


Figure 2. Trends in establishment of wildlife reserves in Jordan.

In 1978 the RSCN began the captive breeding program, with plans to re-introduce sand gazelle, Nubian ibex, Arabian oryx, roe deer, fallow deer, Persian onager and blue-necked ostrich.

The following are some basic statistics of this program, based on Budieri, 1995 (Appendix 10) and Abu-Eid, 2002⁵.

Table 1. Captive breeding program summary at Nature Reserve in Jordan.

Species	Captive Breeding Started	Number at start (Females)	Number at last count (year)	Date of first release
Oryx	1979	11	200 (1999)	2001
Blue-necked ostrich*	1979	3	52 (2000)	
	1983	3		
	1990	4		
Persian onager	1989**	4 (2)	6 (2000)	
Roe deer	1986	3 (2)	12 (2000)	
Nubian ibex	1989	23	24 (2000)***	1998
Sand gazelle	1979	10 (9)	5 (2000)	
Persian fallow deer	1983	4	n/a****	

* The Arabian ostrich, *Struthio camelus syriacus*, is extinct and re-introduction is planned with the closely related blue-necked ostrich, *S.c. molybdophanes*. Some red-necked ostriches, an inappropriate subspecies, were acquired at various times and kept separate from the blue-necked subspecies.

** A pair of Persian onagers was acquired in 1983 but both died. Four more were acquired in 1989.

*** 24 remaining in enclosure after 34 released in 1998 and 32 more in 1999-2000

**** After acquiring 4 Persian fallow deer in 1983, the RSCN discovered that they were the Eurasian subspecies and passed them on to a private farmer as it would inappropriate to re-introduce the wrong subspecies.

Arabian Oryx Population

The female gives birth once a year and she is pregnant for a period of 255 days. She gives birth to one offspring.

The population built up from 5 in 1983 to 313 in 2000, when the RSCN began releasing them (Figure 3). The first release was into the Wadi Rum Nature Reserve.

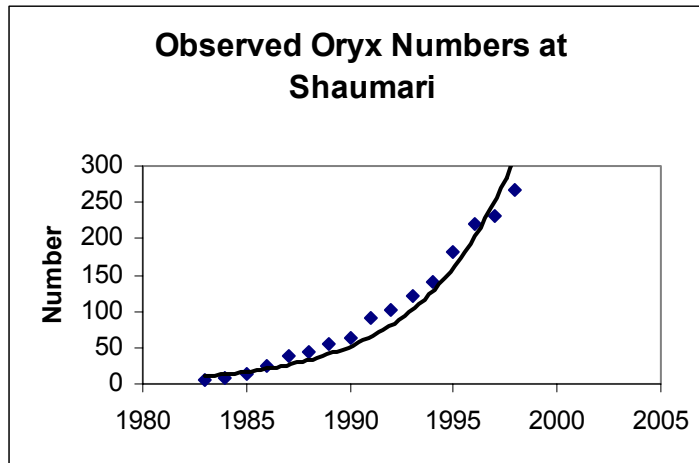


Figure 3. Oryx numbers at Shaumari, calculated from the oryx log.

Boef (1996) suggested that a wild population of 1,500 oryx in Jordan was possible and could be attained in 5-10 years. Based on the observed growth rate at Shaumari, a hypothetical growth rate for Arabian oryx re-introduced into good habitat until reaching that population maximum is shown in Figure 4.

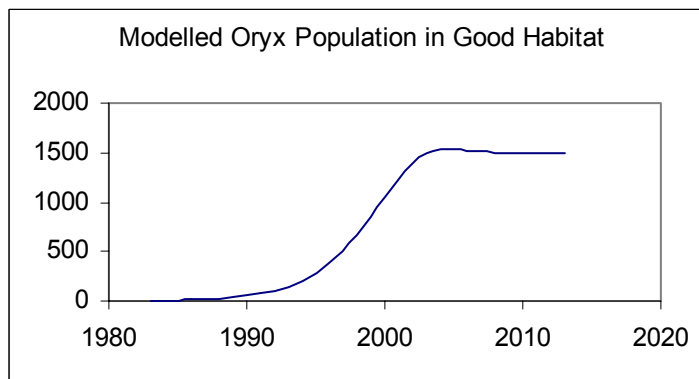


Figure 4. Modelled growth rate for oryx re-introduction into good habitat.

The habitat in most of Jordan is not good, however, owing to centuries of overgrazing. It was less overgrazed in 1990 than now. In 1990, 1991 and 1992, Irmaileh (1994) [6] found that

grazed areas adjacent to Shaumari Nature Reserved produced 22.8%, 33.3% and 11% of the amount of vegetation produced by an adjacent protected area in 1990, 1991 and 1992, respectively (Figure 5). 1991 and 1992 had progressively more rainfall, so that the total plant production was greater, even though the ratio of grazed:ungrazed production declined. Irmaileh (1994) also found that protection from grazing markedly increased plant species diversity. Hatough-Bouran and Al-Eisawi (1990) [7] found that all seven species of rodents were strongly correlated with vegetative cover at Shaumari, and the high populations encountered (compared to unprotected areas) were in response to the vegetation growth and the development of diverse microhabitats that resulted from protection from grazing.

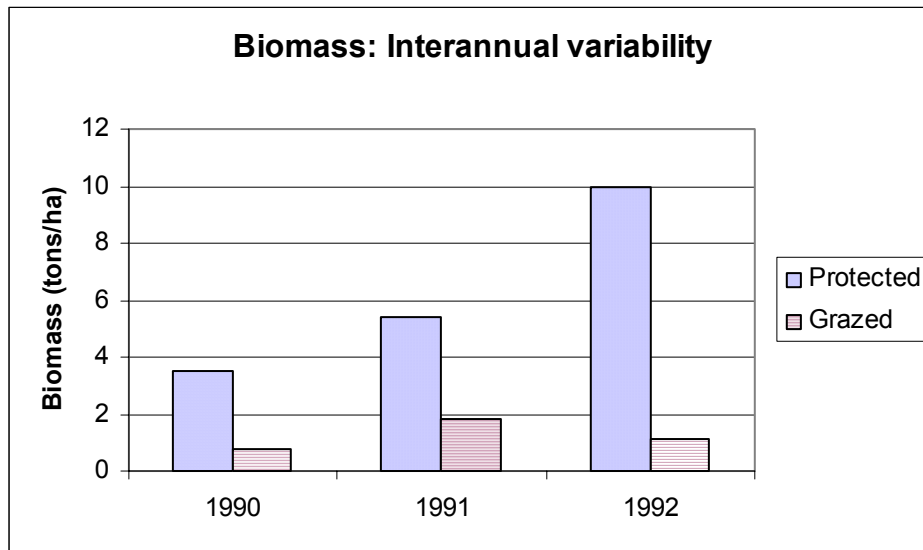


Figure 5. Biomass standing crop in grazed and protected areas

If the Arabian oryx had been re-introduced into the proposed wildlife reserves at Wadi Rajil or Burqu in about 1991 as planned, had not the overgrazing occurred, they would have had gone into better habitat than the range around Shaumari, and they would have had partial protection from grazing and complete protection from hunting. As a rough estimate, a productivity level of 50% of oryx habitat outside the reserve is suggested, taking the habitat at Shaumari (until the oryx population began to exceed the carrying capacity) as 100%. Based on a 50% lower growth rate, the population would grow as shown in Figure 6, reaching a target population of 1,500 and a zero growth rate in about 2035.

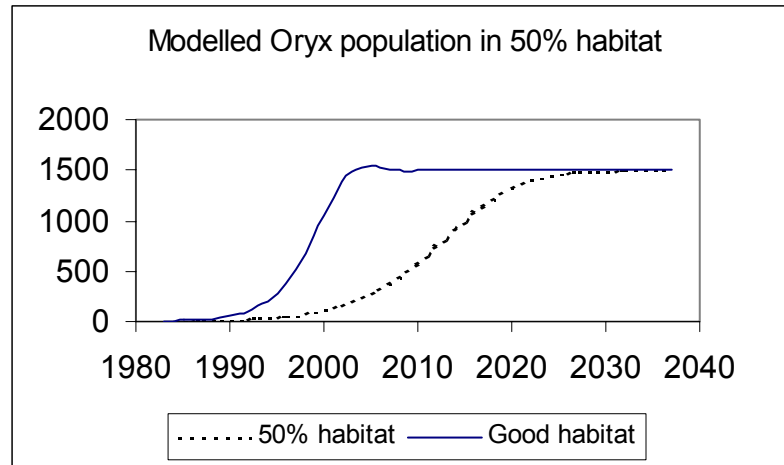


Figure 6. Oryx growth rate in 50% degraded habitat compared to good habitat.

Sand Gazelle Populations

Based on a review of the literature and consultation with mammalogists in Jordan [8], about 5,500 km² of potential sand gazelle habitat are available, although currently badly overgrazed. Since the maximum density of this species is about 1/km², the theoretical maximum population of Jordan would be 5,500. The extant population numbers only a handful, if any.

At Shaumari, the population grew from 11 in 1980 to 34 in 1990 but then plunged to 22 in 1991 and 14 in 1992 (Figure 7). Budieri, 1995 (Appendix 10) reported that, “Transmission of highly contagious diseases (*Pasteurella*, PPR etc.) ... played a major role in the lack of increase in the[gazelle] herd” at Shaumari during 1990-1991.

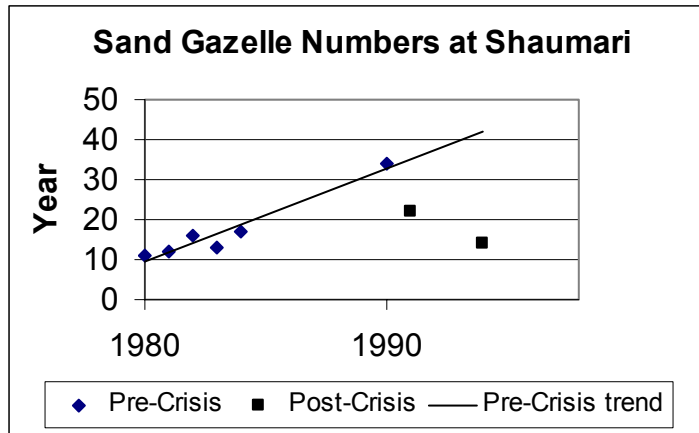


Figure 7. Sand gazelle population at Shaumari based on RSCN records.

Based on the observed growth path up to 1990, the rate fits a density-dependent model as shown in Figure 8. Clearly, the population was at the early stage of its growth curve and never reached the carrying capacity estimated by RSCN of 250 gazelles at Shaumari.

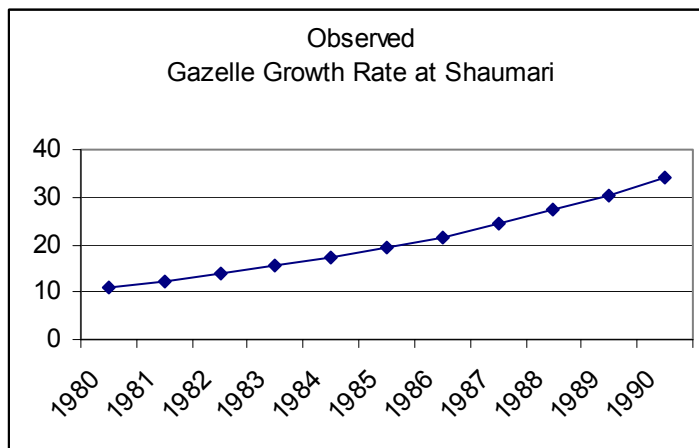


Figure 8. Population of sand gazelles at Shaumari fit to model parameters.

If sand gazelles had not began succumbing to disease and other problems in the captive breeding facility, and had been re-introduced into a wildlife reserve at Wadi Rajil or Burqu, they would probably have followed a growth path as shown in Figure 9. The population reaches carrying capacity of 5,500 animals in about 2060.

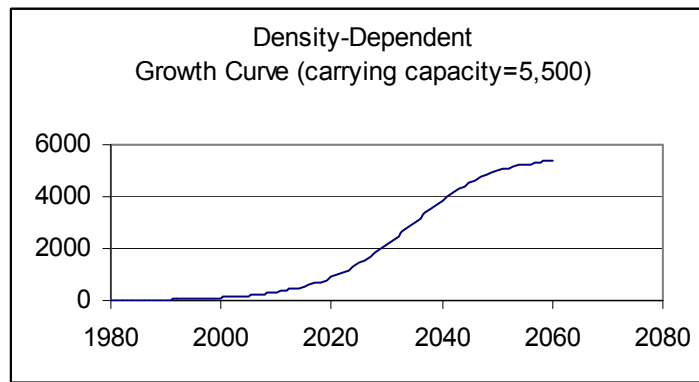


Figure 9. Modelled growth curve for sand gazelles if re-introduced into moderate habitat.

DISCUSSION

From the available literature and statements of present and former RSCN officials, it is clear that the deterioration in range conditions and transfer of diseases from livestock during 1990-1991 were factors in deferring some of the re-introduction programs, but not the only factor. GCEP (1995)⁹ highlighted the deterioration of range condition as an obstacle to re-introduction and stated that:

“...depletion of water resources and livestock grazing have resulted in considerable habitat degradation in many parts of Jordan. In order to enable potential release sites to receive species from the captive-breeding programmes rangelands in Jordan must be fully rehabilitated.”

This general statement would apply particularly to the species of the Badia (gazelles, onagers, ostriches, oryx). Gazelles and oryx had high rates of disease during 1990-1991, although only the former apparently suffered a reduced captive population as a result. Gazelles also did not breed well, and may have suffered additional mortality, because of behavioural response to confinement. The captive oryx population at first grew at an exponential rate typical of introductions into good habitat, and then began to level off about 1995 in response to deteriorating browse availability within the reserve as noted by GCEP (1995) and Boef (1996) [10]. Lack of professional wildlife expertise over technical issues such as which subspecies was appropriate, as well as lack of space for breeding facilities at Shaumari, were also factors in poor success of species other than oryx. In 1995, for example, the RSCN was planning to proceed with re-introduction of Persian fallow deer once the roe deer programme had become firmly established; however, because captive breeding success was poor for roe deer, the Persian fallow deer program was never resumed.

The oryx population at Shaumari was under full time care in good habitat with ideal conditions for oryx and water provided by staff. The observed growth rate was far above what would be expected under natural conditions. The captive breeding population reached maximum carrying capacity in about 1995 and productivity began to level off; no oryx were released into the wild, however, until 2000 when 10 were released at the Wadi Rum Nature Reserve. The re-introduction at Wadi Rum became possible after a 308 km² wildlife reserve was

created in 1989 and the RSCN staff then waited for 11 years until the habitat improved to the point that re-introduction was feasible.

The gazelles at Shaumari had behavioural problems resulting from confinement, and did not prosper as they might have in the wild. On the other hand, until 1990, they had adequate space and good care. On balance, the rate observed at Shaumari prior to 1990 probably approximated the rate that would have obtained had they been released into wildlife preserves at Burqu and/or Wadi Rajil, as was planned.

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