CAPTIVE BREEDING AND REINTRODUCTION OF ARABIAN MOUNTAIN AND SAND GAZELLES IN SAUDI ARABIA

Mohammed, O.B., Wacher, T.W., Nader I.A. and Mubarak, S.M., King Khalid Wildlife Research Centre, National Commission for Wildlife Conservation and Development, P. O. Box 61681, Riyadh 11575, Saudi Arabia.Conservation Programmes, The Zoological Society of London, Regents Park, London NW1 4RY, United Kingdom.

Introduction

King Khalid Wildlife Research Centre (KKWRC) was established in 1986. One year later, the management of the animal collection was given to the Zoological Society of London on behalf of the National Commission for Wildlife Conservation and Development (NCWCD). Different species of gazelles kept at the Centre are for breeding, research and reintroduction purposes. Three species of gazelles are kept at the Centre. These are: the Arabian mountain gazelles, *Gazella gazella*, locally known as Idmi together with *Gazella gazella erlangeri*, locally known as Khudri; the Arabian sand gazelle, *Gazella subgutturosa marica*, locally known as Reem and *Gazella dorcas* of African origin. Before transferring these gazelles, they were free ranging in a 600-hectare animal enclosure. Reem and Idmi gazelles were obtained from the wild but their exact location was unknown. The group of dorcas gazelles were obtained from Sudan while the Khudri gazelles were donated to the Centre by the National Wildlife Research Centre (NWRC) in Taif. This paper will focus on the management practices applied to the *Gazella gazella* and *Gazella subgutturosa marica* at KKWRC as well as on preparing gazelles for release into the protected areas in Saudi Arabia.

One of the difficult tasks that faced the Centre at the early stages was to catch all gazelles and separate the species from each other. Gazelles together with many other animal and bird species including ostriches and emu were all free ranging in a large 600-hectare enclosure. Catching the gazelles was first attempted by using chemical immobilization of individual gazelles. Darting of individual gazelles was carried out from the back of the truck used to distribute food for the gazelles. Gazelles would follow the truck while food was being distributed and darting of gazelles would be done at this stage. This method was successful to a limited extent but the gazelles soon learnt to associate the feed truck with darting and they stopped following the truck when food was distributed. A mass capture method, drive-in boma, was thought of by building a triangular boma with a chain link, 1.75 m high, rising to 2 m at the narrower capture end. The inside was covered with canvas to prevent gazelles from seeing outside the boma. This provided protection and reduced the chances of the gazelles charging the fence at the risk of serious injury. Gazelles were fed inside the boma for sometime before the main entrance of the boma was closed with many gazelles inside. The gazelles were then darted individually and transferred to different pens. This method resulted in some injuries as a result of gazelles being restless inside the boma (more than 25%). An alternative method was tried. This involved the use of the New Zealand boma, which is used primarily to catch deer in New Zealand. It is also called a pop-up boma. Gazelles are baited with feed in a 60 m circle of canvas laid flat on the ground but attached via cables to a circle of vertical poles. When weights attached to the cables are triggered from a remote location the canvas is pulled suddenly upward via pulleys over the poles forming a circular enclosure 2 m high. Gazelles enclosed in this way can then be handled individually by darting or catching them by hand and placing them individually in dark, well ventilated, wooden crates. The latter is best achieved by using hand held canvas sheeting to restrict them to one side of the boma, and is the preferred method because darting gazelles inside the boma was again associated with high mortalities. Once under individual control in crates gazelles were then sampled and transferred to the breeding pens.

Breeding Pens Design

The breeding pens at KKWRC consist of some 80 separate rectangular pens each c. 100x50 m. built in a circular array around the central laboratories and offices of the breeding centre. The perimeter fence around the whole area is reinforced in order to prevent predators, chiefly feral dogs, from entering the pens.

Individual pens are made of chain link, 3.5 mm thick with a mesh of 5x5 cm. The height of the fence varies from 1.75-3 m depending on gazelle species. Idmi gazelles tend to jump which is why 2 m height fence line is appropriate for them, whereas 1.75 m is sufficient for Reem gazelles. Three straining wires and poles (5.8 cm diameter) are provided to give support to the fence line. A double fence is provided to separate pens from each other in order to prevent nose-to-nose contact. Draping fences between pens with shade netting increases the barrier effect by reducing both air borne debris from circulating between

pens and reducing visual stimuli that would otherwise promote attempted aggression between males through the fences. Tree and earth mounds provide a refuge for newborn gazelles from predators especially migrant eagles which can be present in large numbers at certain times of the year. Feeding and watering troughs are close to the entrance of the pen. The breeding pens hold breeding gazelles as well as single sex groups. Each breeding group is composed of 10 female and one male for Reem and *Gazella dorcas* and 4 females and one male for Idmi gazelles (Kichenside and Lindsay, 1997). Gazelles feed on either fresh or baled alfalfa and a concentrate ration of gazelle pellets Superlac 16% (Arasco, Saudi Arabia). Each pen is provided with a mineral salt block in order to supplement minerals, which are needed by gazelles. In each breeding pen there is a capture facility in order to facilitate catching gazelles for different management purposes.

Vaccination and Preventive Medicine

Gazelles are normally handled for vaccinations, sample collection for laboratory investigations and for other veterinary medical procedures. Gazelles at the Centre are vaccinated annually against Pest des Petits Ruminants (PPR), Foot and Mouth Disease (FMD) and clostridial infections. A blood sample is collected annually from all gazelles and subjected to ELISA TB testing. This test is undertaken because tuberculosis was detected in the Arabian oryx and gazelles at the early stages when the Centre was established (Rietkerk *et al*., 1992). Blood and tissue samples are also collected from gazelles for genetic studies. Faecal samples are collected from all breeding pens twice a year in order to check for gastrointestinal parasites. Gazelles are dosed annually with a broad spectrum anthelmintic in order to get rid of parasites. During the rainy season a prophylactic dose of sulpha compounds is applied in the drinking water in order to control coccidian parasites infecting gazelles (Mohammed and Flamand, 1996).

Record Keeping

The Animal Record Keeping System (ARKS) is the main database of the collection. Details of every individual gazelle are updated regularly. At birth newborn gazelles are caught by hand and fitted with a temporary small plastic eartag. Identification of the correct dam is facilitated by fitting breeding females with lightweight colour coded collars. The singleton males in each breeding group are known and identifiable. A permanent metal tag is applied to all gazelles at weaning. All eartags and eartag numbers are related to an individual accession number for each gazelle registered within the ARKS package, where details of individual life histories are maintained by regular updates.

Reproduction in Reem and Idmi Gazelles

Arabian sand gazelles (Reem) are seasonal breeders. The rutting season in captivity starts late in October and early November. The observed gestation period is 155 days and the calving season starts late in March and early April. Over 90% of the Reem births in captivity are twins and in the wild 70% twinning has been observed in some seasons (Wacher and Kichenside, 1998). The Arabian mountain gazelle (Idmi) are aseasonal breeders and they breed throughout the year. The gestation period is approximately 155 days based on the minimum interbirth interval of 167 days (Lindsay, personal communication). No twins were reported in Idmi births either in captivity or in the wild (Kichenside and Lindsay 1997; Dunham, 1997).

A project dealing with cyropreservation of semen from Reem and Idmi gazelles has been initiated in collaboration with the Reproductive Biology Department of the Institute of Zoology, The Zoological Society of London. The objective of this project is to study semen characteristics from Reem and Idmi male gazelles and have a genetic resource bank. This will help in any future work with regard to artificial insemination in Arabian gazelles.

Reintroduction Programmes

The need to reintroduce gazelles from captive bred populations was identified at an early stage by NCWCD and endorsed by an International Conference on Conservation of Arabian Gazelles (Greth *et al*., 1996). In line with conference recommendations, the International Union for Conservation of Nature and Natural resources (IUCN) guidelines for reintroduction were followed when planning the reintroduction programmes (IUCN 1995). Reem and Idmi gazelles for reintroduction are managed and bred at KKWRC for this purpose. Key subsidiary recommendations in this approach to reintroduction are that only appropriate taxa are released within their former historic range and that the original cause of extinction has been identified and controlled or eliminated. Gazelles reintroduced by KKWRC have all been placed into former range areas in newly created unfenced protected areas where ranger forces are present to prevent hunting. Extensive taxonomic research, including molecular genetics research, has been undertaken to ensure appropriate identification in this famously difficult group (Greth *et al*., 1996; Hammond *et al*., 2001).

Mountain gazelles have been reintroduced by KKWRC at the Ibex Reserve and Uruq Bani Ma'arid in the Empty Quarter (Dunham *et al*., 1993; Wacher and Kichenside, 1998). Sand gazelles have been reintroduced at Uruq Bani Ma'arid, with a significant additional project carried out jointly with the National Wildlife Research Centre (NWRC), Taif at the very large fenced reserve at Mahazat as Sayd (Haque and Smith, 1996).

Selection of Gazelles for Release

Only clinically healthy gazelles are considered for reintroduction. The male: female ratio is 1:2 with some juvenile groups included. Through the captive breeding program and ARKS record keeping system, individual gazelles are selected to maximize genetic representation as far as possible. Gazelles selected for release are subjected to extensive disease screening protocol including screening for tuberculosis. All gazelles selected for release are screened for tuberculosis using an ELISA test developed at the Centre and are required to test negative at least three times over the year prior to release. As an additional check a blood TB test (BTB) is performed for all gazelles being reintroduced. The BTB tests are carried out in a cooperative arrangement with the Deer Research Laboratory in New Zealand. Any gazelle with a reaction is removed from the reintroduction programme and replaced by a healthy animal. Screening for toxoplasmosis and brucellosis is also carried out at KKWRC (Mohammed and Hussein, 1994) and any gazelle with positive reaction is excluded from the released gazelles. Faecal samples are collected from all gazelles considered for release and investigated for gastrointestinal parasites and their products. Any sample showing faecal eggs is treated accordingly and the gazelles then subjected to another investigation before release to make sure that it is free of parasites. Every gazelle selected for reintroduction in vaccinated against rabies, brucellosis and pasteurellosis in addition to the routine vaccines given to all gazelles at KKWRC. A dose of a broad spectrum anthelmintic will be given to each gazelle considered for reintroduction. Finally in the case of sand gazelle reintroductions, a proportion of females are deliberately managed to be pregnant at the time of release to bring forward the timing of first parturition and enlarge the effective founder group size at the release site. Social groups for reintroduction are assembled in individual breeding pens for several weeks prior to transport.

Transport of Gazelles to the Protected Area

Gazelles are transported to the protected areas during the cool weather, in the winter or spring time, in order to not expose the gazelles to heat stress. Gazelles are boxed into specifically designed crates. Crates are narrow and allow the gazelle to stand or lie inside but do not permit the gazelle to turn around. Crates measure 100 x 36 x 90 cm, can be opened from both ends and each crate is provided with 30 - 40 ventilation holes. The crates are dark so that gazelles cannot see and stay quiet. A dose of long acting narcoleptic (Haloperidol) is administered to the Idmi gazelles before transportation to keep them quiet during the journey. This has not been found necessary with Reem gazelles which are consistently less inclined to struggle and resist when restrained. Crates are loaded in the truck and they are stacked in a way so that they are not pressing against one another and marked so that the correct social groups can be reassembled at the release site. On reaching the protected area gazelles are held in pre-release pens for 4 weeks so that they become familiar with landmarks in the area and adapt to natural vegetation in the pens as a food source. Through this period, familiar food and water used in captivity is also provided to facilitate transition to the new conditions.

Reintroduction of Idmi Gazelles in the Ibex Reserve

The Ibex Reserve (23? 30' N and 46? 30' E) is located 150 km south of Riyadh in central Saudi Arabia. The reserve covers c. 1800 km^2 and comprises a series of deep and steep sided canyon wadis separated by a gently undulating, stony, limestone plateau, 800 -1100 m above sea level (Dunham *et al*., 1993). The area supports a viable indigenous population of wild Ibex (*Capra ibex*) which have been traditionally protected by the local population (Habibi 1994). Residents also report that mountain gazelles lived in the area until they were exterminated by hunting thirty years ago. The Ibex Reserve was formerly protected by NCWCD in 1986, following a consultative process with a representative committee of local citizens, and the reintroduction of the mountain gazelles agreed upon as a management objective for the reserve.

During 1991-1992 a total of 54 (18.36) mountain gazelles were transported to the reserve and kept in a pre release pen built in the reserve for a period of 4 weeks before they were released into the protected area. The pre release pen was positioned to enclose a variety of natural vegetations including grasses, forbs and bushes so that the gazelles were exposed to a range of potential foods available in the reserve. *Acacia* trees provided shady resting sites. While in the pre release pen, food and water were provided *ad libitum*. Following release a rapid initial population increase was observed (Dunham, 1997) followed by a partial decline (Dunham, 2001) followed by evidence of stabilisation and persistence to date.

Release of Reem gazelles in Mahazat as Sayd

Mahazat as Sayd lies 150 km northeast of Taif in western Saudi Arabia. It is a fenced reserve covering an area of 2244 km^2 of open desert steppe habitat (Child and Grainger, 1990). The topography of the area is gentle with elevations ranging from 900 -1100 m above sea level depending on whether it is in wadis or basalt relief. The majority of the reserve area (96%) is covered with sand including gravel. It was declared a protected area in 1988 as a primary site for reintroduction of the Arabian Oryx (*Oryx leucoryx*), Houbara bustard (*Chlamydotis undulate macqueeni*) and ostrich (*Struthio camelus*). Mountain gazelles and the Afri gazelle were probably the principle resident species in this area, although Sand gazelles were also recorded (Vesey-Fitzgerald, 1952). The Arabian Oryx was reintroduced into the reserve during 1989 and the Arabian sand gazelle (*Gazella subgutturosa marica*) was reintroduced into the area during 1990. A total of 135 (58.77) Reem gazelles were transported to the reserve during 1990 (Haque and Smith, 1996). They were kept in pre release pens for a period of 2–3 months where they were vaccinated, tagged, bled for disease screening and fitted with radiotransmitters for radiotracking. Follow up studies have shown that this population increased to a peak of some 2000 gazelles by 1999 before experiencing losses. It is currently believed to be stable or increasing.

Release of Reem and Idmi gazelles in Uruq Bani Ma'arid

Uruq Bani Ma'arid (18° 30' – 20° N 45° – 46° 15' E) is located in the western edge of the Empty Quarter desert (Child and Grainger, 1990; Abu Elzein *et al.*, 1998). It is entirely unfenced, covering an area of 12000 km^2 mixed use areas, with a central core zone of 2200 km^2 sector defined as a strict wildlife reserve. During 1995 -1996 groups of 205 Reem and 72 Idmi gazelles were transported to the protected area in order to be released there. Gazelles were selected carefully as outlined above. At this site five prerelease pens were constructed at three different locations within the core area of the reserve, allowing successive release of social units, numbering 10-20 animals each, following periods of 4-6 weeks acclimatisation with food and water provided before release into the wild. Post-release monitoring of Sand and Mountain gazelles at Uruq Bani Ma'arid has relied on both radio-collaring (c. 20% of individuals) and individual indentification collars on all other released gazelles (wild born gazelles from these projects remain untagged). The survival and the dispersal of gazelles in the protected area and their acclimatisation to the new environment has been recorded showing that the numbers and dispersion of both species have increased substantially since reintroduction. Importantly it has also become clear that ecological differences between the two species predicted from the known behaviour of remnant wild stocks of these species have clearly been preserved to re-emerge in released populations derived from captive founders. This information constitutes a valuable experience for any future reintroduction programmes.

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