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Ex situ management of Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar

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Al Wabra Wildlife Preservation (AWWP), Qatar, is the only facility worldwide to keep the Beira antelope *Dorcatragus megalotis*, a small antelope from East Africa, listed as Vulnerable by *The IUCN Red List of Threatened Species*. Physical, behavioural and physiological characteristics of the species are described in detail, based on observations in captivity. At AWWP, the Beira antelope population increased from 2000 until 2006 when it declined dramatically as a result of an epidemic-like outbreak of a respiratory disease most likely owing to a *Mycoplasma* infection. Management at AWWP includes a diet based on natural forage, careful group composition, enclosure design adapted to the need of the species and close monitoring. Apart from their important conservation status, Beira antelope are highly attractive animals with a particular shape and coloration, and a docile nature.

Key-words: Beira antelope; biological data; ecology; husbandry; nutrition; social behavior; social organization; status.

INTRODUCTION

The Beira antelope *Dorcatragus megalotis* was first described in 1894 (von Menges, 1894). However, little appears to have been known about the biology and life history of this remarkable small antelope species; for example, in a renowned paper on the behaviour of antelopes, Jarman (1974) did not know how to classify the social behaviour of this species. Detailed descriptions of the biology of Beira antelope have only occurred very recently (Hammer & Hammer, 2005; Giotto *et al.*, 2008). Beira antelope originate from East Africa; their area of distribution is the southern coast of the Gulf of Aden to the Horn of Africa in the east, to the borders of Somalia, Ethiopia and Djibouti in the west,

and to the Marmar Mountains in north-eastern Ethiopia (Künzel & Künzel, 1998; Nowak, 1999; Heckel *et al.*, 2008). Their typical habitat is arid mountain with sparse vegetation, where they inhabit altitudes of up to 2000 m in small, territorial groups (Giotto *et al.*, 2008; C. Hammer, pers. obs). Beira antelope belong to the Neotragini, the dwarf antelopes, and are considered related to the Steenbok *Raphicerus campestris* and grysbok (*Raphicerus* spp), the dikdiks (*Madoqua* spp) and the Oribi *Ourebia ourebi*. The scientific name *Dorcatragus megalotis* is of Greek origin and means ‘big-eared antelope’ (Huffman, 2009).

Since the 1980s, there have been repeated attempts to maintain and breed Beira antelope at Al Wabra Wildlife Preservation (AWWP), Qatar, with little success. Most animals died because of malnutrition, heat, and parasitic and infectious diseases. From before 1999, no detailed records exist about the number of imported animals and their fate. In March 1999, 25 Beira antelope were captured during an expedition to Somalia (in the area of Hargeisa) and flown to Qatar. At this time, 1.3 (♂♀) animals were still alive at AWWP from previous expeditions. By July 1999, only 2.6 adult animals were still alive and these represent the founding stock for the current AWWP population: the only *ex situ* population to date. Descriptions presented here are based on observations of this population and on free-ranging animals during a field trip to Djibouti in 2003.

CONSERVATION STATUS

Because of long-term political unrest, the natural habitat of the Beira antelope can only be accessed with difficulty, so their actual status in Somalia and Ethiopia can only be speculated upon. The most recent estimates are based on field observations from 2004 in Djibouti (Giotto *et al.*, 2008, 2009), where the political situation has stabilized since 1997 so that field observations are possible. The Beira antelope is classified as Vulnerable (Heckel *et al.*, 2008; IUCN, 2009). Protected areas or *in situ* programmes do not exist to date. Since 1997, there is a general hunting ban in Djibouti that also benefits the Beira antelope.

Because Beira antelope are very territorial and sedentary, goat and sheep herds kept in nomadic systems represent a serious threat in terms of resource competition and infectious diseases. With an increasing population and a growing number of boreholes that facilitate nomad access to previously unused areas, this threat is increasing. Habitat fragmentation, hunting, droughts and soil erosion are additional threats (Heckel *et al.*, 2008; Giotto *et al.*, 2009).

EXTERNAL APPEARANCE OF THE BEIRA ANTELOPE

The head, the lower extremities and the outside of the thighs have a reddish coloration (Plate 1). A dark band, reaching from the shoulders to the flank, separates the greyish neck and back from the reddish-cream-coloured belly side. The insides of the thighs are also cream coloured. The hips are slightly higher than the shoulders. The brown eyes have a white margin. From the lateral corner of each eye, a black band reaches along the base of the ear towards the back of the head, where it joins that of the other side. The muzzle and chin area are also of a brighter coloration. The remarkably large ears have a dark edge and the outer coloration is reddish. The hairs inside the ear are long and white, but are interspersed with bands of shorter, black hair that give the ears their distinctive

appearance that can be used for individual identification of animals.

The hairs of the neck region are longer and tougher than the rest of the fur and probably protect Beira antelope against the thorns of the plants that form their natural diet. The bushy tail is very short. Beira antelope have interdigital glands but no preorbital glands. Only ♂♂ carry small, straight horns that can reach up to 12 cm and may form rings at their base. From a distance, these horns might be difficult to detect because of the large ears. Apart from the horns, there is no sexual dimorphism; ♂♂ and ♀♀ are equal in size and body mass. Representative body measurements of adult Beira antelope are listed in Table 1.

The dental formula of Beira antelope is the same as that of other ruminants: 0/3 incisors, 0/1 canines, 3/3 premolars and 3/3 molars (maxillary/mandibular).

NATURAL DIET

Free-ranging Beira antelope feed on leaves and buds of shrubs in their natural habitat, as well as succulents, herbs and grasses. Lists of food plants can be found in the literature (Kingdon, 1997; Künzel & Künzel, 1998; Giotto *et al.*, 2008) but data on the relative proportions of these plants in the diet are missing. Beira antelope are assumed to be predominantly browsers (Gagnon & Chew, 2000; Giotto *et al.*, 2008). Personal observations of the author and isotopic analyses of a single faecal sample of a free-ranging Beira antelope (T. Tütken, pers. comm.) support this view. Unpublished data on the digestive anatomy of Beira antelope from AWWP would result in a classification of the species as an intermediate feeder (M. Clauss, pers. comm.). The water content of their natural diet most likely makes Beira antelope independent from surface water.

REPRODUCTION

Mating and birth

The reproduction of Beira antelope was presented in detail by Hammer & Hammer



Plate 1. Captive Beira antelope *Dorcatragus megalotis* displaying the typical coloration patterns of the species.
Catrin Hammer.

MEASURE	RANGE	MEAN
Body mass	9–14 kg	11 kg
Shoulder height	54–60 cm	57·1 cm
Total body length	88–98 cm	93·7 cm
Croup (rump) height	61–66 cm	63·1 cm
Tail length	5–8 cm	6·7 cm
Breast circumference	47–51 cm	49·1 cm
Neck circumference	19–22 cm	20·3 cm
Horn length	9–12 cm	10 cm
Distance between horn bases	4–5 cm	4 cm
Ear length	13 cm	13 cm

Table 1. Body measurements of Beira antelope *Dorcatragus megalotis* collected from 18 adult individuals at Al Wabra Wildlife Preservation.

(2005). In the wild, a seasonal (Kingdon, 1997) or bi-seasonal birthing pattern has been reported (Giotto *et al.*, 2008). A certain seasonality appears evident in the captive population (Fig. 1) but, generally, Beira belong to those antelopes that appear to lose their naturally seasonal breeding pattern when kept in captivity (Piening Schuler, Hammer, Clauss & Hammer, 2009). Most ♀♂ mate quickly after birth and, hence, have

the next calf c. 6·5 months later. Only primiparous ♀♀ at AWWP have a longer first interbirth interval of 10–12 months, whereas this interval is 6·5–8 months in multiparous dams.

Mating is brief but is repeated frequently during the day. During foreplay, the ♂ follows the ♀ and approaches her from behind with a stretched-out neck and raised tail. He sniffs her genital area, displays ‘flehmen’ (curling of the upper lip which facilitates the transfer of scents into the vomeronasal organ) and urinates frequently. The ‘laufschlag’ (foreleg kicks) typical for bovids occurs sometimes but not always. The ♀ indicates receptiveness by standing still and raising her tail. During mating, the ♂ stands on his hind legs as do most hoofed mammals.

Observed pregnancies at AWWP lasted between 186 and 209 days with an average of 194 days (6·5 months). One single offspring is born (Plate 2). Most births at AWWP occurred in the early morning, noon or early afternoon, but not in the evening or at night. The dam is not separated from the group and neither is the ♂. First signs of

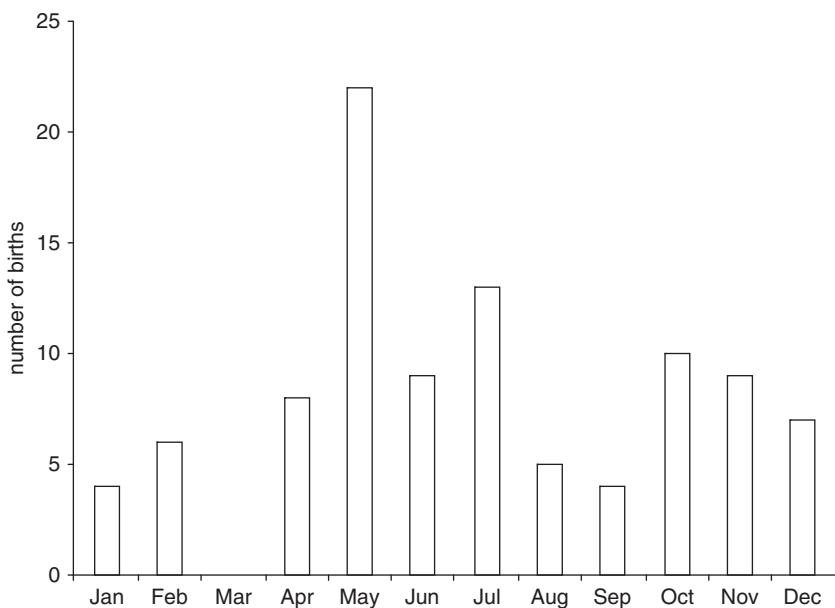


Fig. 1. Months of births for Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar (2000–2008).



Plate 2. Newborn Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar. *Catrin Hammer.*

labour are usually observed 90 minutes before birth. The actual expulsion usually lasts 20 minutes. As in other ruminants, anterior presentation of the calf, with forelegs and head appearing first, is the norm. Mothers often get into tactile contact with the calf while the latter is still in the birth canal. Usually, mothers start cleaning their young directly after birth. Beira antelope calves are fully developed and precocious. They try to stand immediately after birth. Calves usually reach a standing position 20–40 minutes after birth and start searching for their mother's udder, which usually does not take longer than another 10 minutes. Beira antelope calves are hiders (remain hidden and separated from their mother except during nursing periods) and are visited by their mothers for nursing only. The placenta is usually ejected 30–60 minutes after birth and directly ingested by the mother; however, only partial consumption or complete neglect of the placenta also occurred at AWWP.

Five to 13 days after birth, the ♀ comes into oestrus again; if the according mating is not successful, another oestrus follows after 24–26 days. Oestrous cycles appear to differ between individuals but were observed to be constant for each individual at AWWP. Oestrus lasts between 12 and 24 hours. After an abortion or neonatal death, oestrus can occur as early as 4 days after the event.

Neonate development

At AWWP, Beira antelope neonates are nursed between two and nine times during daylight hours. Twelve days after birth the nursing frequency decreases. A nursing bout lasts between 10 and 180 seconds (mean 120 seconds). Most nursing was observed in the morning between 0500 and 0900 hours and in the evening between 1700 and 1900 hours. Animals are not observed overnight but it was assumed that nursing also occurs during the night; this could be corroborated by weighing calves in the late evening and again in the early morning. On individual occasions, nursing of calves by ♀♀ other than their own mothers was observed but, mostly, mothers

chase off offspring that are not their own. Weaning occurs after 3–4 months.

Similar to other dwarf antelopes, Beira antelope calves have a high body mass as compared with that of their mothers. Weighing 1500–1700 g at birth, calves represent c. 13% of adult body mass. Mass gain in the first 8 days is between 50 and 200 g (mean 100 g) per day. There are no gender-specific differences in weight gain. After 2–3 weeks, calves have doubled their birth mass. They gain body mass rapidly until they are 2 months old, after which body-mass gains decelerate markedly. At the end of its 12th month, a calf has usually attained the typical adult body mass of 11 kg (Fig. 2). In contrast to the brown eyes of adult animals, the iris of newborn Beira antelope has a yellow coloration. This fades to brown after c. 9 months of age.

Beira antelope calves start to nibble at solid food as early as 2 days after birth. At an average of 9 days after birth they regularly ingest solid food and rumination is observed consistently at 3 weeks of age.

The group latrines are frequented by calves after 3–10 days of age for defecation and urination. Typical pawing is observed in young ♂♂ from about 3 weeks of age onwards. Female Beira antelope attain sexual maturity at 2 years of age. In one case, a ♀ gave birth to her first offspring at 14 months of age, which means that mating must have been successful at 9·5 months of age. However, this was a rare exception. Males start to become sexually active at 8 months of age and perform their first successful mating on average at 11 months of age. With the onset of sexual maturity, aggression between young ♂♂ and their sire also begins.

BEHAVIOUR

Beira antelope live in small territorial family units, consisting of an adult ♂, several ♀♀ and their offspring (Giotto *et al.*, 2008; C. Hammer, pers. obs). Peak daily activity periods at AWWP are in the early morning and the later afternoon, similar to Beira antelope in the wild (Giotto *et al.*, 2008). However,

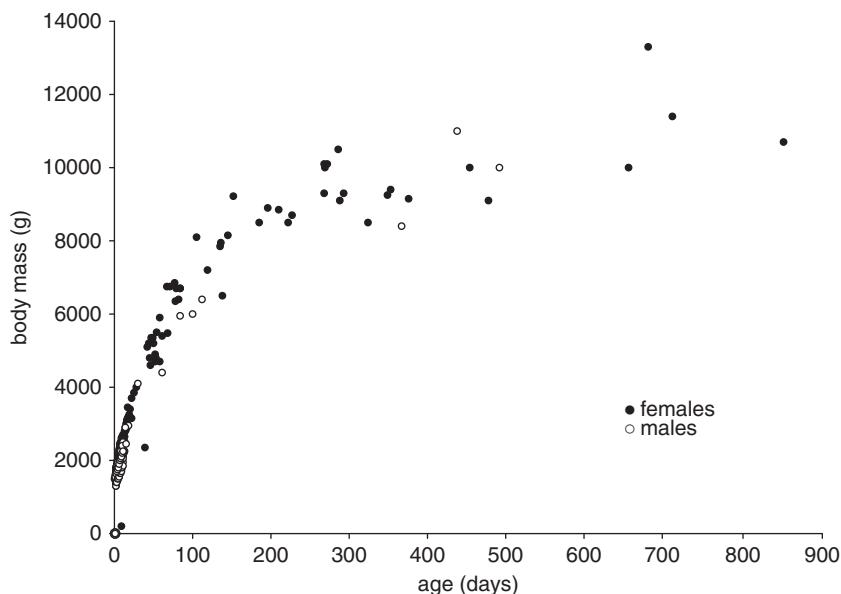


Fig. 2. Body-mass development for Beira antelope *Dorcatragus megalotis* juveniles at Al Wabra Wildlife Preservation, Qatar ($n = 8$ ♂♂; $n = 26$ ♀♀).

during the colder winter months at AWWP activity bouts are more regularly distributed across the whole day, indicating a major influence of ambient temperatures on activity patterns.

Defecation

The maintenance of common latrines (where all members of the group defecate) probably serve to mark the territory (Giotto *et al.*, 2008; C. Hammer, pers. obs). At AWWP, these latrines have a diameter of 3–4 m and are usually located on soft ground. Two or three latrines are usually maintained simultaneously by one group in their enclosure. After c. 6 months, a latrine is abandoned and a new location chosen for the next one.

Defecation appears to be a group ritual in the Beira antelope at AWWP. All members of a group defecate in close sequence or simultaneously. Similar behaviours have been described as a ‘dunging ceremony’ in other dwarf antelopes, such as dikdiks (Estes, 1991; reviewed in Giotto *et al.*, 2008), and

may provide group cohesion as well as territory marking. First, ♀♀ approach the latrines, sniff, paw the ground, urinate and defecate subsequently. Afterwards, the ♂ approaches the latrine, seemingly attracted by the behaviour of the ♀♀. He sniffs all recent dung piles, often displaying ‘flehmen’ behaviour, scratches soil over the ♀♀’ dung piles, urinates in an upright position and subsequently defecates in a typical squatting posture (Plate 3). Similar behaviour was described for animals in the wild (Giotto *et al.*, 2008).

Adult ♂♂ control the latrines of their group regularly and an ‘untended’ latrine is a typical sign of either an all-♀ group without a mature ♂ or of a diseased ♂. Females use latrines even in the absence of a ♂ in the group, whereas ♂♂ in bachelor groups do not maintain latrines but defecate anywhere.

In stressful situations, such as births, ♀♀ in oestrus or introduction of new animals into a group, both the adult ♂♂ and the dominant ♀♀ defecate in unusual places all around the enclosure. At AWWP after hierarchy quarrels, dominant ♀♀ repeatedly chased away

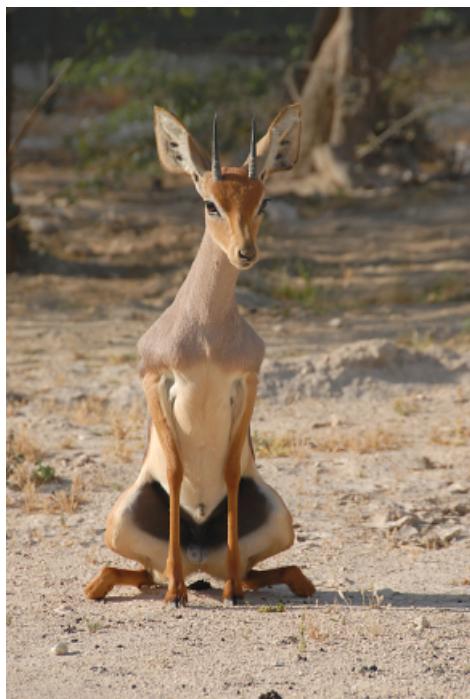


Plate 3. Beira antelope *Dorcragus megalotis* ♂ in typical squatting defecation posture. Catrin Hammer.

other ♀♀ from their resting place and defecated in that place.

Greeting/appeasing

When coming into contact, animals slowly approach each other with a stretched-out neck and often duck down. They touch the other's head, flank or genital region with their nose (Plate 4), while producing gentle, snorting sounds.

In stressful situations (introduction of new individuals, hierarchy quarrels, oestrus, chasing by other animals), Beira antelope duck or lie down. This behaviour is often displayed by all group members, irrespective of gender and age. Animals circle each other in such crouched positions and smell each other's heads, flanks or genital regions. Usually, tensions subside quickly and animals resume their normal body stance. Twice a mother

antelope was observed approaching the dominant ♂ in the described submissive posture when the ♂ had repeatedly attacked her ♂ offspring (8 months of age at the time). The ♀ thus deflected the ♂'s attention.

Aggression

Aggressive behaviour is rare in established groups with a clear hierarchy. At times, maturing ♀♀ are put in their place by older ♀♀ with headbutts against the flank or the shoulder. Male juveniles are tolerated up to 10 months of age but attacks by the dominant ♂ can occur earlier, especially when ♀♀ of the group are in oestrus. At AWWP, cases are documented where ♂♂ attacked and hurt ♀♀, which even led to the death of a ♀ in one case. The reasons for these attacks were not evident: in one case, a 12 month-old ♂ attacked a ♀ of the same age, with which he had been living together peacefully for the preceding 8 months, with such vehemence and persistence that the ♀ died from its wounds. The same ♂ showed a similar behaviour in other group constellations and he always picked on one ♀. Once this ♀ was removed from the group, he would focus his attention on another one. After several pairing attempts, this ♂ was put into solitary confinement when he also proved to be incompatible with bachelor groups.

Another case of aggression was less spectacular but even more interesting. One ♂ dominated two ♀♀, which were both in a weak body condition and did not become pregnant. Veterinary inspections did not yield conclusive results. Intensive observations revealed that the ♂ consistently pursued these two ♀♀, chased them off their resting places and even hit them with his horns when they offered themselves to him for mating. When the ♂ was exchanged for another ♂, the body condition of both ♀♀ improved within 2 months and both became pregnant.

Most aggressive actions were observed between a dominant ♂ and a ♀. In one case, aggression of a ♀ against a newborn was observed. A ♀ that had not produced any offspring of her own attacked newborns of



Plate 4. Two Beira antelope *Dorcatragus megalotis* in typical greeting ritual. Catrin Hammer.

the group with such vehemence that she had to be removed from the group for a couple of days. Afterwards, she accepted the new group members without problems.

Vocalization

During 8 years of observing Beira antelope, seven easily distinguishable vocalizations could be identified in this species.

- Whimpering of calves to contact their mother.
- A cry of fear from calves.
- Mother calling her calf.
- Greeting: a gentle, stuttering snort.
- Tongue clicking as a warning: at this click, all group members react with increased alertness and readiness for flight.
- The augmentation of the click is a loud snort that usually leads to flight of the whole group.
- A long drawn-out peacock-like cry that indicates a state of excitement; this was always caused by the introduction of new individuals to a group or fear triggered by humans or severe attacks by cage mates.

HUSBANDRY AND MANAGEMENT AT AWWP

Enclosure management and design

At AWWP the average group size of around 1.4 adult individuals and their offspring mirrors observations on group compositions in the wild (Giotto *et al.*, 2008). At its peak (2005/2006) there were 12 breeding groups plus some separated individuals maintained at AWWP. The individual enclosures at AWWP, including a 36 m² house and a separation corridor of 2 m width (linked to adjacent enclosures, the house and a loading dock), comprise an average area of 900 m² (Fig. 3). The house is equipped with air conditioning, which is considered essential at temperatures above 35 °C. Animals have permanent access to the outdoor enclosure and the house. As the antelope did not use bedding material this is no longer offered except in cases of illness or exceptional cold. In these cases, infrared heaters are installed indoors and are regularly used by the animals. In the colder months (December to March), animals are locked indoors overnight and

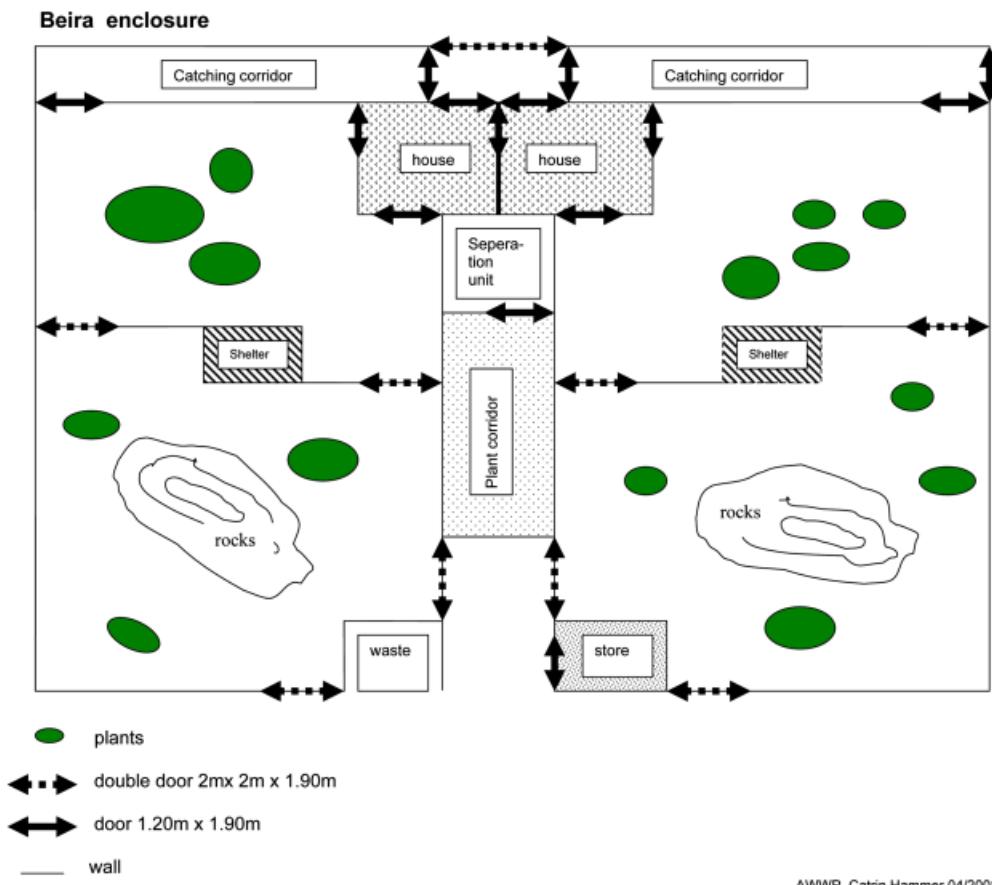


Fig. 3. Scheme for Beira antelope *Dorcatragus megalotis* enclosure at Al Wabra Wildlife Preservation, Qatar. Green circles indicate protected bushes. Arrows indicate doors.

houses are heated with electric heaters. Ambient temperature is maintained at 20 °C.

The enclosure is fenced with mesh wire (5·3 cm × 5·3 cm) that is 2 m high or surrounded by a solid wall of similar height. In order to prevent the animals from running into the mesh-wire fence, the lower 80 cm either consists of a stone wall or is covered by canvas to give a solid appearance. The capture corridor is fenced by a similar stone wall or by canvas supported by mesh wire. The corridor is open to the top, apart for the loading dock. When capture is intended (e.g. for transfer to more distant enclosure units), animals are fed in the capture corridor rather

than forced into it. The antelope usually also have access to the corridor, which, in conjunction with the house, provides a circular path of movement, allowing animals to avoid each other without the danger of being cornered.

In the experience of AWWP, Beira antelope are particularly susceptible to a wet cold. Nevertheless, they often do not seek shelter in their houses but remain outdoors in the rain. As this can result in cold and hypothermia, animals are usually locked indoors during such weather conditions.

In the experience of AWWP, evasion options are important for flight animals and

provide a feeling of safety. Therefore, the enclosures are furnished with natural vegetation and an artificial rock of 3–4 m in height, as well as sight barriers consisting of twigs. This results in various shady and sunny areas. The ground consists of solid soil and rock. At first, enclosures were filled with sand but this was removed when some groups showed excessive hoof overgrowth.

Diet and feeding

The feedstuffs currently used in the diet of Beira antelope at AWWP are listed in Table 2. The natural vegetation growing in the enclosures and in the planted corridors consist mainly of *Leucaena leucocephala*, *Acacia reficiens*, *Acacia mearnsii*, *Acacia nilotica*, *Prosopis juliflora*, *Pithecellobium dulce*, *Eucalyptus maculata*, *Ziziphus spina-christi*, *Phoenix dactylifera* and various grasses. The amount of food taken from this growing vegetation is minimal as compared with the diet offered. Note that the diet offered comprises a large proportion of browse (Table 2). Food is offered twice daily (Table 3). Browse twigs and fresh lucerne are hung from fences or mesh protecting vegetation in the enclosure; the other feeds are given in elevated food bowls of varying height that are distributed around the enclosure (an important measure for limiting access to food by rats and mice). A high number of these bowls and their distribution across the enclosure encourages the animals to spend more time foraging and allows individuals of lower status to access food at the same time as the dominant animals. Apart from the mineral licks and the minerals available via the compound feeds, an additional mineral mix is fed to the animals, either mixed into the fruits and vegetables, or dissolved in water and sprayed onto the browse.

Beira antelope are observed not only to consume the browse leaves but also sometimes even thin twigs, bark or the long thorns of some acacia species. Additionally, dry palm leaves are also eaten regularly.

Fresh water is available at all times but the animals also drink the brackish water used to

FEEDSTUFF	PROPORTION OF TOTAL DIET (% AS FED)
Fresh browse: <i>Acacia mearnsii</i> , <i>Acacia nilotica</i> , <i>Acacia reficiens</i> , <i>Acacia tortilis</i> , <i>Ziziphus spina-christi</i> , <i>Leucaena leucocephala</i>	57
Fresh lucerne	23
Carrots, apples, cooked potato (to deliver mineral/vitamin mix)	5
Pelleted compound feed for small ruminants	12
Pelleted compound feed with vitamin E	1
Cooked maize	1
Oat flakes	1
Mineral mix	4 g per animal per day
Calf starter compound feed	additional food offered during cold weather or during lactation
Dried lucerne	<i>ad libitum</i>
Twigs, palm leaves	<i>ad libitum</i>
Mineral lick with increased copper content	<i>ad libitum</i>

Table 2. Feedstuffs offered to Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar.

water the enclosure vegetation. At AWWP, Beira antelope drink regularly and are observed to drink more frequently during the hot summer months. Three times per week a phosphorus supplement is dissolved in the drinking water, because the phosphorus status of many animals at AWWP was found to be low (Hammer *et al.*, 2006). Even after extensive experimentation with different products, the acceptance of the mineral licks offered remains limited; some animals have never been observed using them.

Group composition

Based on observations of free-ranging animals, Beira antelope breeding groups at AWWP consist of one adult ♂ and three to four adult ♀♀, and their offspring. The ♂ is never separated from the group but breeding

	VEGETABLES	SAFARI PELLETS	COOKED MAIZE	FRESH LUCERNE	BROWSE	DRY LUCERNE, TWIGS, PALM LEAVES	OAT FLAKES	VITAMIN E PELLETS	MINERAL MIX
Morning	30 g	75 g	10 g	140 g	1 branch c. 350 g	ad libitum	10 g	5 g	2 g
Afternoon	30 g	75 g		140 g	1 branch c. 350 g			5 g	2 g

Table 3. Daily feeding regime for one Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar.

♂♂ are exchanged based on their age, health and genetic representation in the population. It is thought that a low neonate mortality (17%) and a high success in raising juveniles (96% of surviving neonates) advocates the use of these small breeding units. There was only one case of a ♀ that consistently neglected its offspring.

The breeding ♂ dominates the group. The ♀♀ have a hierarchy but this is difficult to discern in established groups. Offensive actions between ♀♀ are rare and mostly observed when an animal of a group dies or a new animal is introduced into the group. At AWWP, new adult ♀♀ are not added into existing groups. Female offspring replace their mothers in breeding groups. However, if a ♀ had to be isolated for medical reasons, reintroduction into its former group may be necessary and is always a challenge. After a period of visual and olfactory contact through a wire fence, the newcomer is first introduced to the lower-rank ♀♀ of the group. The dominant ♀ is only brought to the group after an indeterminate time period; in some cases, the dominant ♀ had to be removed repeatedly before the group was stable. Such integration takes 2–3 weeks to achieve. If a completely new group has to be assembled, it is advisable to put all animals into an enclosure that is not familiar to any member of the group, to avoid giving any individual an advantage.

Juveniles that cannot be integrated into their dams' breeding groups are collected in single-sex groups at the age of 6–8 months; new breeding groups are later formed with habituated ♀♀ and an introduced breeding ♂. Males raised together in bachelor groups can be kept together even after sexual maturity up to the age of 1.5 years; this is usually not possible with ♂♂ that were raised separately or that have led a breeding group in the past. Therefore, sufficient space for keeping individual ♂♂ removed from the actual breeding groups is essential.

Daily routine and handling

Routine work, such as the daily feeding, cleaning, watering and monitoring have led

to the Beira antelope at AWWP being very habituated to human contact, resulting in calm, companionable groups. Individual animals even take food from the hands of keepers. Enclosures are nearly always entered by keeping personnel with animals present, with the exception of work that results in high noise production, such as tree felling.

Different methods for the capture of individual Beira antelope have been tested at AWWP over the years. Hiding neonates up to 7 days of age are captured by hand, using a towel to cover the eyes. Older animals are pushed along a corridor with a blanket, which is put over the animal at the end of the corridor; usually, the animal lies down at once and can be restrained through the blanket. At the end of such a corridor, which can also be formed of canvas, the animal can also be pushed into a transport box (90 cm × 40 cm × 70 cm high), in which routine procedures, such as vaccinations or blood sampling, can be performed. If chemical immobilization is necessary, a regime of ketamin ($1.8 \pm 0.6 \text{ mg kg}^{-1}$) and medetomidin ($0.060 \pm 0.008 \text{ mg kg}^{-1}$) antagonized by atipamezol ($0.34 \pm 0.04 \text{ mg kg}^{-1}$) delivered intramuscularly has been used successfully (Martin Jurado *et al.*, 2007).

Veterinary management

All newborn Beira antelope are subjected to an intensive prophylactic treatment regime (Table 4). A low juvenile mortality and few juvenile diseases (Nagy *et al.*, 2008) appear to support this regime (Fig. 4).

All Beira antelope are routinely vaccinated once per year against *Clostridium perfringens*, Pasteurella and Mannheimiosis (Heptavac P Plus[®]). During the regular faecal examination, the following endoparasites could be diagnosed: nematodes, trichostrongylus and giardia, which were successfully treated with fenbendazole (Panacur tablets 250 mg[®]) at a dose of 15 mg kg^{-1} per day for five consecutive days. Coccidia were treated with Toltrazuril (Baycox 5% oral solution[®]) at a dose of 20 mg kg^{-1} every 3–4 weeks. Ectoparasites were never diagnosed.

DAY	DRUG
1	1 ml kg^{-1} BW Biofakt [®] , sc 1 ml kg^{-1} BW Biofakt [®] , orally Earmotch
2	1 ml kg^{-1} BW Bio Weyxin 700 K [®] , orally 2 ml Bryonia, sc Transponder
3	1 ml kg^{-1} BW Biofakt [®] , orally 2 ml Bryonia, orally 0.1 ml kg^{-1} BW Copavet [®] , sc 0.2 ml kg^{-1} BW Vitaselen [®] , sc
4	2 ml Bryonia, orally 1 ml kg^{-1} BW Biofakt [®] , orally
5	2 ml Bryonia, orally 1 ml kg^{-1} BW Biofakt [®] , orally
30	2 ml Heptavac [®] , sc 2 ml Bryonia, sc
60	2 ml Heptavac booster vaccination, sc

Table 4. Neonate treatment protocol for Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar: sc. subcutaneous.

Blood and faecal samples, as well as cytological and bacteriological samples are investigated at the AWWP internal laboratory. For further diagnostics, including histological and virological investigations, samples are sent to various laboratories in Europe or Dubai. Each deceased animal is subjected to a thorough in-house necropsy (Fig. 5).

The major causes of death of Beira antelope at AWWP are diseases of the respiratory and urinary tract. The frequent lung and kidney infections appear to be caused by a respiratory disease, fibrinous pleuropneumonia syndrome (FPPS), that started occurring in January 2006 with acute and peracute deaths (Hammer *et al.*, 2007; Nagy *et al.*, 2008) (Fig. 6). Main symptoms are nasal discharge, coughing and eye infections, with arthritis in some individuals. During necropsy, fibrinous pleuropneumonia, kidney abnormalities and amyloidosis are evident. We know today that the cause of FPPS is a mycoplasma infection (Nagy *et al.*, 2008), most likely without the involvement of a viral infection (Lechenne *et al.*, 2009). Because the infectious agent has not been identified, a

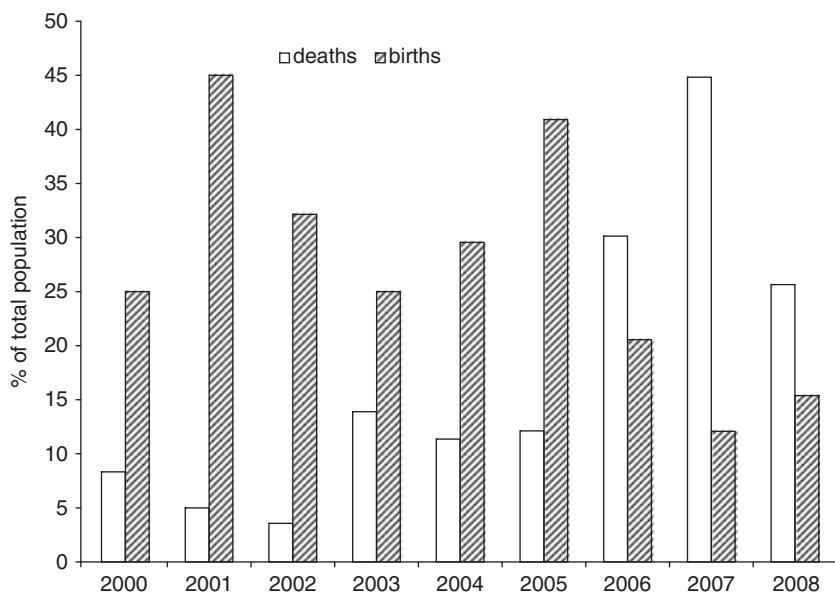


Fig. 4. Comparison of birth and death rates in Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar (2000–2008).

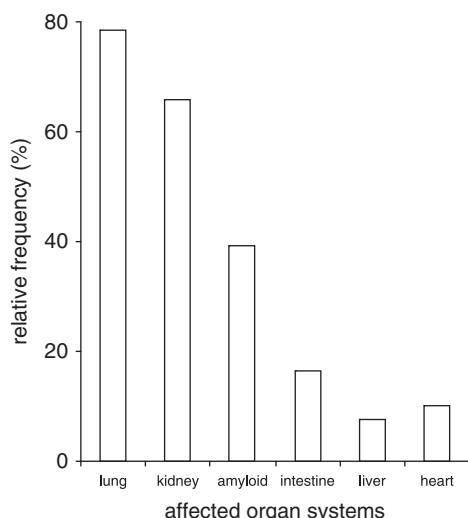


Fig. 5. Affected organ systems (a generalized amyloidosis) in deceased Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar, between 2000 and 2008 ($n = 79$ antelope).

prophylactic vaccination is not possible. Attempts to hand-raise neonates isolated immediately from their mothers to establish an

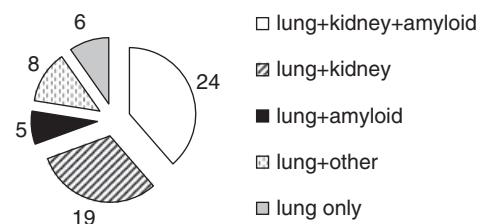


Fig. 6. Necropsy reports for lung disease (in combination with other findings) in Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar ($n = 62$ antelope).

infection-free population (Piening Schuler, Hammer & Hammer, 2009) have been unsuccessful to date; however, because these animals were cooperative they were easy to treat. Treatment is symptomatic and supportive. The syndrome led to a crash of the captive population (Fig. 7). The most recent neonates are left with their mothers but are treated continuously with antibiotics during their first 2 months of life. To date, these animals do not show any symptoms. The search for the infectious agent continues.

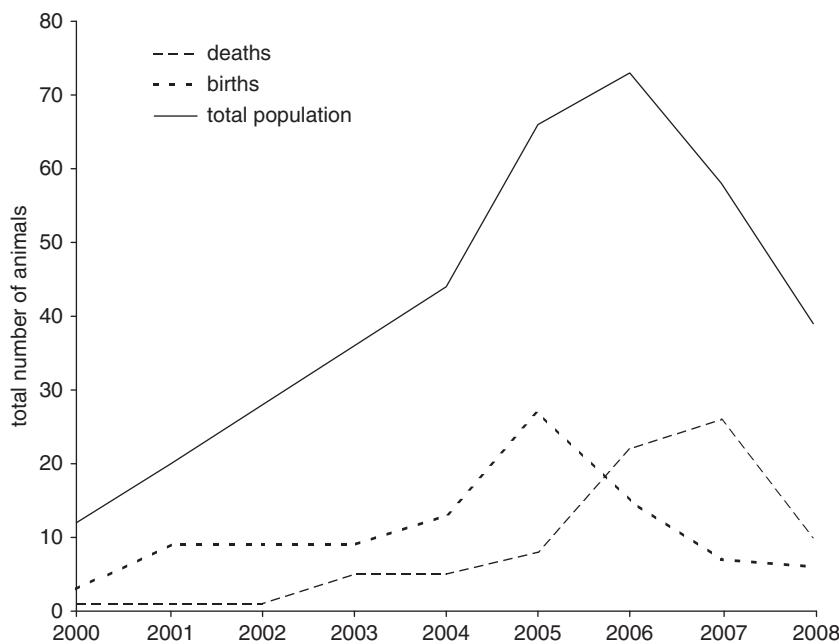


Fig. 7. Population development of Beira antelope *Dorcatragus megalotis* at Al Wabra Wildlife Preservation, Qatar (2000–2008).

CONCLUSION

The Beira antelope is classified as a threatened species with a need for conservation and AWWP is a significant contributor to the current scientific knowledge on the species. Irrespective of the fate of the current AWWP population, this knowledge will remain the springboard for all future *in situ* and *ex situ* conservation efforts for *D. megalotis*.

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PRODUCTS MENTIONED IN THE TEXT

Baycox 5% oral solution[®]: toltrazuril, anticoccidial, manufactured by Bayer, 51368 Leverkusen, Germany.

Bio Weyxin 700 K[®]: oral vitamin complex, manufactured by Veyx, Pharma GmbH, Söhreweg 6, 34639 Schwarzenborn, Germany.

Biofakt[®]: colostral immune globulines from cattle with specific antibodies against three different *E. coli*-lines, rotavirus and coronavirus, manufactured by Albrecht, 88323 Aulendorf, Germany.

Bryonia Inject-forte[®]: homeopathic treatment, manufactured by Plantavet, 88339 Bad Waldsee, Germany.

Calf starter compound feed: manufactured by 50469 Raiffeisen, Köln, Germany.

Copavet[®]: copper supplement, manufactured by C-Vet Limited, Western Way, Bury St Edmunds, UK.

Heptavac P Plus[®]: immunization against clostridia and pasteurella, manufactured by Intervet, Unterschleißheim, Germany.

Mineral block: mineral lick (with high copper/sele-nium), manufactured by Saudi Pharmaceutical Industries, Riyadh, Saudi Arabia.

Mineral mix: manufactured by Blattin, Höveler, 41542 Dormagen, Germany.

Panacur tablets 250 mg[®]: fenbendazole treatment for nematodes, manufactured by Intervet, 85716 Unterschleißheim, Germany.

Pelleted compound feed for small ruminants: manufactured by Altromin, 32791 Lage, Germany.

Pelleted compound feed with vitamin E: manufactured by Ele-Vit, Mazuri, Witham, Essex, UK.

Vitaselen®: vitamin E/selenium supplement, manufactured by Selectavet, 83629 Weyarn Holzolling, Germany.

REFERENCES

- ESTES, R. D. (1991): *The behaviour guide to African mammals*. Berkeley, CA: University of California Press.
- GAGNON, M. & CHEW, A. E. (2000): Dietary preferences in extant African Bovidae. *Journal of Mammalogy* **81**: 490–511.
- GIOTTO, N., LAURANT, A., MOHAMED, N., PREEVOT, N. & GERARD, J. F. (2008): Observations on the behaviour and ecology of a threatened and poorly known dwarf antelope: the beira (*Dorcatragus megalotis*). *European Journal of Wildlife Research* **54**: 539–547.
- GIOTTO, N., OBSIEH, D., JOACHIM, J. & GERARD, J. F. (2009): The population size and distribution of the vulnerable beira antelope *Dorcatragus megalotis* in Djibouti. *Oryx* **43**: 552–555.
- HAMMER, C. & HAMMER, S. (2005): Daten zur Fortpflanzung und Jungtierentwicklung der Beira-Antilope (*Dorcatragus megalotis*). *Der Zoologische Garten NF* **75**: 89–99.
- HAMMER, S., HAMMER, C., SCHULZ, J., WERNERY, U. & CLAUSS, M. (2006): Biochemische serum-parameter bei in Gefangenschaft gehaltenen Gazellen. *Tierärztliche Praxis* **34G**: 190–196.
- HAMMER, S., GULL, J. M., NAGY, A., BORJAL, R. J., DEB, A., ARIF, A., TAHAN, A., ROBERT, N. & CLAUSS, M. (2007): Fibrinous pleuropneumonia syndrome (FPPS) in beira antelopes at the Al Wabra Wildlife Preservation, Qatar. *Verhandlungsbericht Erkrankungen der Zootiere* **43**: 68.
- HECKEL, J. O., RAYALEH, H. A., WILHELMI, F. & HAMMER, S. (2008): *Dorcatragus megalotis*. In *The IUCN red list of threatened species*. Gland, Switzerland, and Cambridge, UK: IUCN. <http://www.iucnredlist.org/apps/redlist/details/6793/0> (accessed 27 September 2010).
- HUFFMAN, B. (2009): *Your guide to the world's hooved mammals*. Toronto, ON: Available at <http://www.ultramutualteungulate.com>
- IUCN (2009): *The IUCN red list of threatened species*. Gland, Switzerland, and Cambridge, UK: IUCN. Available at <http://www.iucnredlist.org>
- JARMAN, P. J. (1974): The social organization of antelope in relation to their ecology. *Behaviour* **48**: 215–266.
- KINGDON, J. (1997): *The Kingdon field guide to African mammals*. London: Academic Press.
- KÜNZEL, T. & KÜNZEL, S. (1998): An overlooked population of the beira antelope in Djibouti. *Oryx* **32**: 75–80.
- LECHENNE, M., DEB, A. & HAMMER, S. (2009): Serological evaluation of virus exposure in beira antelopes (*Dorcatragus megalotis*) and Speke's gazelles (*Gazella spekei*) at Al Wabra Wildlife Preservation, Qatar. In *Proceedings of the international conference on diseases of zoo and wild animals, 20–24 May 2009, Beekse Bergen*: 248–251. Wibbelt, G., Kretzschmar, P. & Hofer, H. (Eds). Berlin: Leibniz Institute for Zoo and Wildlife Research.
- MARTIN JURADO, O., HAMMER, C. & HAMMER, S. (2007): Beira (*Dorcatragus megalotis*) immobilisation at the Al Wabra Wildlife Preservation. *Verhandlungsbericht Erkrankungen der Zootiere* **43**: 1–3.
- VON MENGES, J. (1894): Eine neue Antilope des Somaliland. *Zoologischer Anzeiger* **17**(444): 130–131.
- NAGY, A., GULL, J. M., DEB, A., ARIF, A., HAMMER, C., WERNERY, U., CLAUSS, M., VÉRHOEVEN, S. & HAMMER, S. (2008): Retrospective evaluation of necropsy reports for beira antelopes (*Dorcatragus megalotis*) at Al Wabra Wildlife Preservation, Qatar – with special focus on the occurrence of a fibrinous pleuropneumonia syndrome (FPPS). *Proceedings of the European Association of Zoo and Wildlife Veterinarians* **7**: 277–286.
- NOWAK, R. (1999): *Walker's mammals of the world* (6th edn). Baltimore, MD: John Hopkins University Press.
- PENNING SCHULER, Y., HAMMER, C., CLAUSS, M. & HAMMER, S. (2009): Birth seasonality in captive bovids at Al Wabra Wildlife Preservation, Qatar. In *Proceedings of the international conference on diseases of zoo and wild animals, 20–24 May 2009, Beekse Bergen*: 297–303. Wibbelt, G., Kretzschmar, P. & Hofer, H. (Eds). Berlin: Leibniz Institute for Zoo and Wildlife Research.
- PENNING SCHULER, Y., HAMMER, C. & HAMMER, S. (2009): Body mass development and survival rate in hand-reared and parent-reared bovidae at Al Wabra Wildlife Preservation, Qatar. In *Proceedings of the international conference on diseases of zoo and wild animals, 20–24 May 2009, Beekse Bergen*: 291–296. Wibbelt, G., Kretzschmar, P. & Hofer, H. (Eds). Berlin: Leibniz Institute for Zoo and Wildlife Research.

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