<u>Restraint of Arabian oryx (*Oryx leucoryx*) in Dubai, United Arab Emirates using a mobile raceway.</u>

D. O'Donovan, Dr T. Bailey*
Wadi Al Safa Wildlife Centre, Dubai, UAE.
Dubai Falcon Hospital, Dubai, UAE

<u>Introduction</u>

Techniques for trapping and restraining ungulates are extremely ancient and Haigh (1999) suggests that most of these were devised as a means of obtaining a source of food. More recently the use of remote delivery drug systems have allowed the safe immobilisation of almost all ungulate species. Most zoological collections today have at some time being faced with a common problem of how to adequately and safely restrain the many and varied species held within their collection. Although the choice adopted, (whether to use chemical or physical restraint) has not changed very much in the last 50 years, the actual components used in the restraint are continually evolving and are rapidly being replaced by better alternatives. Modern anaesthetic techniques and anaesthetics themselves allow for the rapid induction of anaesthesia/sedation thereby allowing quick restraint.

Equipment used for the physical restraint of ungulates has similarly evolved into taxa specific devices which can include a v-shaped drop floor/hydraulically operated squeeze units (Tamer, Fauna Research, Red Hook NY) or variations of these. Many facilities and authors have described different methods of restraint for ungulate species, but most of these refer to the use of chemical methods (Bush 1996; Blumer and de Marr 1993; Atkinson *et al.* 1999; Haigh 1999). Wirtu *et al*. (2005) describes the use of a combination of physical restraint, sedation and behavioural conditioning for repeat sampling in eland (*Taurotragus oryx*). In many instances chemical immobilisation is the method of choice. However, for the restraint of large groups of animals this is not a viable option available to managers and keepers. The problems are further compounded when these animals have to be restrained from within large enclosures and away from the main collection.

The following paper looks at the methods adopted by Wadi Al Safa Wildlife Centre, Dubai, United Arab Emirates to overcome some of these problems. Although primarily developed for the restraint of Arabian oryx (*Oryx leucoryx*), other species such as impala (*Aepyceros melampus*) and blackbuck (*Antilope cervicapra*) have been adequately and safely restrained using similar systems.

<u>Materials and Methods</u>

Location

All the animals used in this study were located within the Emirate of Dubai, United Arab Emirates and were held at four different sites (Fig. 1).
1. Al Awir (N 25º 10.666’ E 055º 33.452’).
2. Wadi Al Safa (N 25º 05.234’ E 055º 15.786’).
3. Seeh Al Salam (N 24º 49.009’ E 055º 15.071’).
4. Muraquab (N 24º 49.159’ E 55º 34.801’).

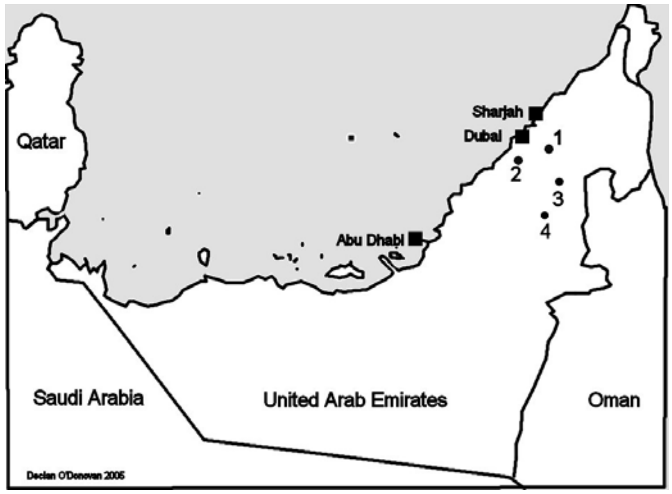

Fig. 1. Locations of each site where animals were sampled from.

Animals

The research followed the guidelines established by Anon (2003), Wehnelt *et al*. (2003) and Smith (2004). All animals apart from those sampled at Muraquab, were the property of Wadi Al Safa Wildlife Centre and were held in 8 established groups of differing age structures and sizes. Each animal was individually marked with a coloured ear tag (Krusse, Germany) and a Trovan RFID microchip (Microchips Australia, Melbourne, Australia).

Environment

Animals were held in enclosures as shown in Table 1.

Table 1. Enclosure location, group type and enclosure size.

Location	Enclosure	Group	Size (ha)
Al Awir	Fence 2	Breeding	2.5
Al Awir	Gazelle 1	Breeding	3
Seeh Al Salam	Gate Pen – Oryx	Breeding	2
Wadi Al Safa	Fence 1	Breeding	10
Wadi Al Safa	Fence 3	Bachelor	3
Wadi Al Safa	Ranches 02	Bachelor	30
Wadi Al Safa	Wadi Al Safa	Breeding	400
Muraquab	Oryx	Breeding	144

Substrate within the enclosures was always natural sand. All food was removed the afternoon before a catch and the new food presented in the mornings was used as an incentive to get the animals into the feeding pen to speed up the initial catch.

Capture

Animals were restrained as part of a postgraduate study and for routine physical and veterinary check-ups. Procedures carried out during the restraint included, blood sampling, general physical examination, rectal temperature, bodyweight, morphometric data collection, administration of anthelmintic treatments and associated hoof management.

Prior to any catch keeping staff were assigned positions such as Catch Coordinator, Catch Foreman, Catch Supervisor and Catch Personnel. Each position has a checklist which needs to be completed and signed off by the person in the position above until such time as the Catch Coordinator deems the site to be ready and the final preparations (installation of the electronics for the remote tripping of the gate) are installed for the following morning. These checklists are in three parts as follows:

1) Mobilisation, installation of restraint equipment and associated equipment.
2) Equipment required for the day of the catch.
3) Remobilisation of raceway and equipment to the stores or new capture site.

The raceway is loaded flat onto trailers and moved to the required site. The number of panels mobilised will depend on the number of animals to be restrained. Installation involves a certain amount of manual levelling of the ground followed by placing the panels onto retaining pins which hold panels in parallel.

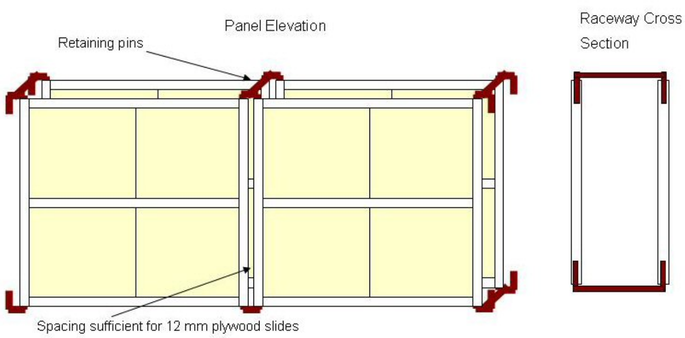

Fig 2. Description of retaining pins holding panel sections together.

The retaining pins (Fig 2) have been manufactured with a spacing sufficient to allow a sheet of 12 mm plywood to act as a sliding door between each 242 cm section panel. The raceway width has been set at 70 cm to allow for the extreme weather conditions of the region. A wider raceway shields the animals and allows for more air circulation while they are being held before restraint.

The ramp which leads up to the Junior Tamer (Fauna Research, Red Hook, New York) together with all the panels (Fig 3) and associated equipment have been manufactured in-house. Movement and placement of the ramp and Junior Tamer is usually aided by the use of mechanical lifting equipment, but can be manually placed into position if required. Normally, installation for the capture of an average group of 15 animals would take about 7 people 5 hours to complete the raceway, ramp and tamer. A further 2 – 3 hours are required to cover and pad objects, which could cause problems during the catch, within the feeding pen and raceway.

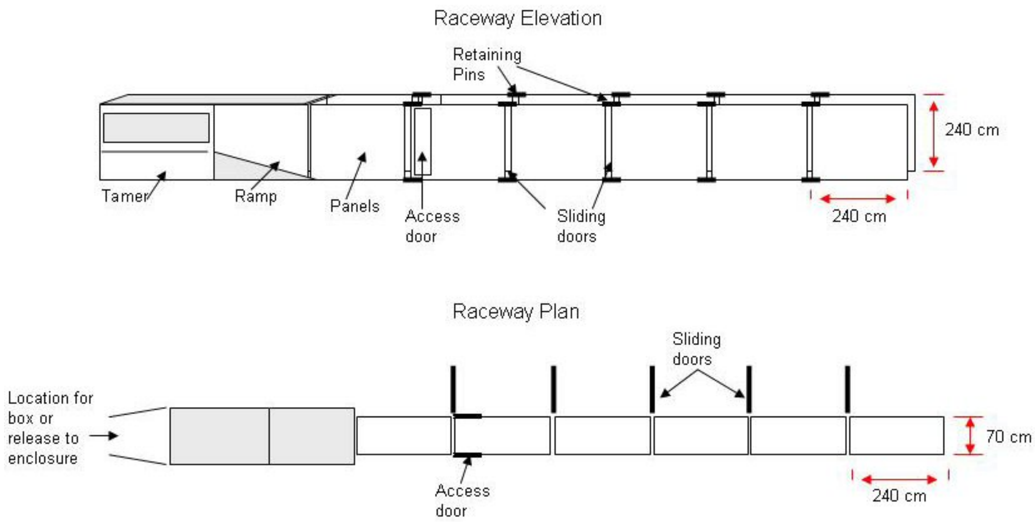

Fig 3. Raceway elevation and plan view (not to scale) Declan O'Donovan 2006

Wherever possible, an elbow (L shape) is added to the raceway. This allows the animals to move forward and around the corner before coming to a barrier, which could cause them to turn back.

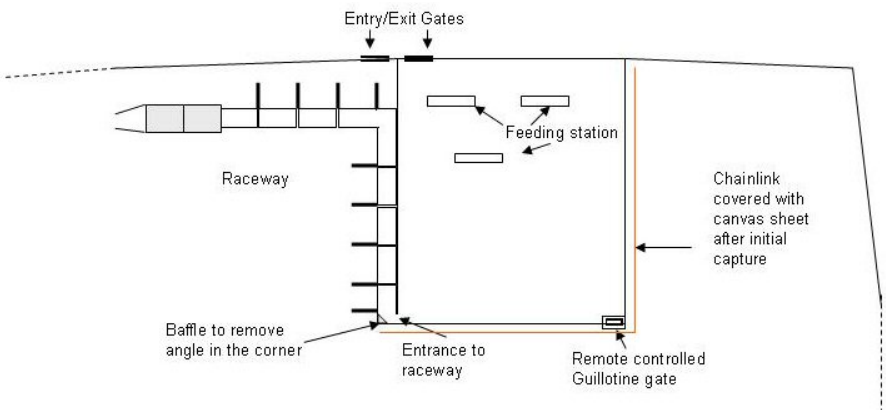

Fig 4. Section of main enclosure detailing the feeding station and completed raceway. Declan O'Donovan 2006

Animals are fed in enclosed feeding pens within the main enclosure (Fig 4). These pens have only one entry/exit gate. Initially, closure of the entry/exit gate was accomplished by the use of a manual pull pin and rope system when all the animals entered into the feeding station. More recently, a remote controlled guillotine gate has been used to catch the animals within this area. This allows remote tripping up to a distance of 200 – 300 m line of sight is now possible.

After the gate is tripped a canvas sheet is suspended on the outside chainlink fence (Fig 4). Other canvas sheets are then used within the feeding pen to encourage the animals into the raceway proper. Once inside they are quickly split into small groups (*n= 2 to 3*) to avoid injury or aggression. From these groups individuals were moved (start of restraint) up a ramp and restrained using the drop floor Junior Tamer. During the research phase of this study, blood and various morphometric data were always collected within the tamer while the animal was restrained. When released, each animal was moved into a further holding box where its weight (± 100g) and height (± 0.25 cm) could be measured accurately. After data collection the animal was either released back to its enclosure or moved to a new location for management purposes (end of restraint). Subsequent to the completion of data collection for the research phase of the study, routine checks (no data collected) involved restraining the animal for general veterinary check up, administration of anthelmintics, hoof checks, body temperatures and faecal collection.

Results

Throughout the course of the study, a total of 328 individual oryx restraints were completed between 3rd April 2004 and 24th April 2005. Of these, data from 263 included information regarding restraint times and are presented here. Data are presented on the basis of sex, age and whether extra data (morphometric information) were collected (Table 2).

Table 2. Descriptive statistics for restraint duration for sex, age and whether extra data were collected.

Sex	Age Class *	Data Collected	N	Mean	Variance	[1] SD	[2] SE
Female	A	No	9	6.778	10.194	3.193	1.064
		Yes	6	12.833	20.567	4.535	1.851
	B	No	2	3.000	0.000	0.000	0.000
		Yes	9	9.222	21.944	4.684	1.561
	C	No	6	5.333	7.467	2.733	1.116
		Yes	18	13.000	39.529	6.287	1.482
	D	No	16	6.438	6.396	2.529	0.632
		Yes	41	9.780	20.526	4.531	0.708
	E	No	6	7.500	9.100	3.017	1.232
		Yes	23	9.783	21.996	4.690	0.978
Male	A	No	5	4.800	0.700	0.837	0.374
		Yes	4	15.750	8.250	2.872	1.436
	B	No	5	6.200	4.700	2.168	0.970
		Yes	16	8.938	9.529	3.087	0.772
	C	No	18	5.389	4.487	2.118	0.499
		Yes	24	9.625	15.984	3.998	0.816
	D	No	7	5.429	5.286	2.299	0.869
		Yes	28	13.750	71.528	8.457	1.598
	E	No	4	8.000	20.667	4.546	2.273
		Yes	16	11.813	11.496	3.391	0.848

* [a] 1wek - 6 months; [b] 6 months - 1 year; [c] 1 year - 2 years; [d] 2 years – 5 years; [e] older than 5 years
[1] standard deviation; [2] standard error

To determine whether restraint time was influenced by either the, age, sex or whether extra data was collected, the data were analysed using a multivariate ANOVA (SPSS 13).

Table 3. Results for 3 way ANOVA of Sex*Age*Data Collection

	Mean Sq	F	Sig
Sex	41.22	1.80	0.181
Age	42.46	1.85	0.120
Data Collected	1392.68	60.66	0.000

Table 3 suggests that neither sex ($p=0.181$) nor age ($p=0.120$) of the restrained animals significantly influenced the duration of restraint. However, the collection of research data (data collected) was determined to be highly significant ($p=0.000$).

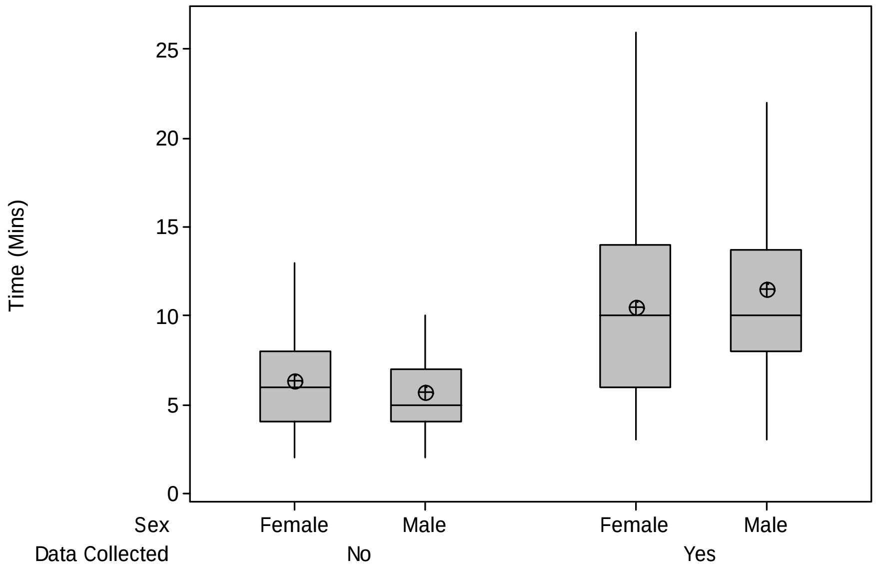

Fig 5. Comparison between males and females when extra data was not collected and when extra data was collected.

Fig 5 indicates the differences in time per animal handling episode between males and females when data was collected and when no data was collected. No empirical data is available regarding the duration of restraint when chemical immobilisation is used. However, it is suggested that to load an animal into a box for transportation, the absolute minimum duration for chemical restraint is between 25 – 30 minutes per animal (O'Donovan unpublished data, Vercammen unpublished data, McKeown unpublished data) without any extra procedures.

Discussion

There is now an increasing realisation that methods of physical capture and restraint for certain species may prove more suitable for routine procedures (Ball, 2000). Habituation and training of the animals to be restrained and of the staff involved in the restraint are very important (Ancrenaz *et al*., 1995; Haigh, 1999) particularly when a large number of animals are being manipulated. Blumer and de Maar (1993) suggest that in the early days of physical restraint when systems designed for the cattle industry were adapted for use with deer, antelope and equid species, problems and injuries have occurred. More recently, however, designs that take into account the size and conformation of the species have proved more useful (Blumer and de Maar, 1993). The more experienced and skilled the operators are, the easier and quicker the operation should proceed. During the course of this study, utilising feeding stations and installing the blinds and raceway a few days in advance conditioned the animals to changes in their surroundings. This allowed a quick initial capture within the feeding pens on the morning of restraint. Most of the animals restrained underwent repeat sampling, but did not show a noticeable shyness to the restraint equipment and were encouraged into the raceway from the feeding pens without injury. However, it was felt that animals which were not exposed to a lot of keeper animal interactions and which were held in larger enclosures were definitely more difficult to move within the raceway and often sat down as a protective measure (O' Donovan *pers obs.*). It was also found that it was imperative that all the animals see where their conspecifics have gone when entering the raceway. An animal turned in the wrong direction spooks and gets very anxious and dangerous when left outside without other members of the herd. Atkinson *et al*., (1999) observed that their study animals rapidly became accustomed to physical restraint and found that 70% showed a decreasing trend in plasma cortisol levels indicating that the animals which they studied were not unduly stressed by regular physical manipulation.

The number of animals that can be restrained and the ease at which the raceway and restraint equipment can be mobilised justifies its use as a management tool for large groups. Molnar and McKinney (2002) reported many complications with the use of chemical immobilisation of Arabian oryx from the same environment as the current study. Activity and excitement before and after drug administration further adds to anaesthesia risks. Arabian oryx within large enclosures tend to run after being struck with an immobilising dart. Inter and intra specific aggression initiated by themselves and initiated towards them by other enclosure members increases dramatically after the onset of anaesthesia in this species (O'Donovan, *pers. obs.*). Ancrenaz *et al.* (1995) reported a 26% mortality rate for anaesthetised Arabian oryx and a 15% mortality rate for Arabian oryx moved in groups. They reported no mortality in Arabian oryx which had been first boma trained and then manipulated physically.

No restraint method will be, or can be, without its problems. Physical restraint has been shown to affect certain blood values indicating that physical restraint is a stressful episode in an ungulates life. Marco and Lavin (1999) found that the method of restraint (physical or chemical) affects various blood constituents in red deer (*Cervus elaphus*). Restraint methods have also been shown to affect blood parameters in mountain gazelle (*Gazella gazellea*) (Rietkerk *et al*. 1994), mouflon (*Ovis ammon*) (Marco *et al*. 1997; Marco *et al*. 1998), Staemboek gilts (Faustini *et al.* 2000) and giraffe (*Giraffa camelopardalis*) (Ball, 2000). Physical capture often results in muscle and liver enzymes being acutely elevated possibly due to capture stress (Vassart *et al.,* 1992; Borjesson *et al.*, 2000). The reasons for these are beyond the scope of this report but, it has been suggested that this is part of the fight-or-flight response (Kerr,1989; Marco *et al.,* 1997). However, even with chemical restraint which is used routinely in the capture of Arabian oryx (Vassart and Greth, 1991 and Flammand 1999) certain blood parameters have been shown by Greth *et al.* (1993) to differ significantly depending on the time when the sample was taken post anaesthesia.

According to Bush (1996) the most important factor governing success in animal handling is the animal facility and suggests that every mammal should be housed under conditions that allow shifting and crating without the use of anaesthesia. The use of a mobile raceway and restraint equipment as in this study gives the flexibility to safely move animals within the collection to remote enclosures, as well as allowing the safe mass treatment and manipulation of animals whenever required.

There have been a number of setbacks with this method which have included two females being euthanased as a result of capture myopathy. Both capture myopathies occurred when the females were being moved in transport boxes to new locations subsequent to the restraint. One male died as a result of asphyxiation within the tamer. This was a result of being left with access to a food supply for too long in the feeding pen prior to movement into the raceway. His weight when dropped in the tamer on a fully engorged stomach caused him to aspirate the rumen contents. One other male died as a result of trauma. This was a result of being allowed to separate from the group and becoming over anxious resulting in him attempting to run through a fence post. Other minor abrasions, scuffing and horn injuries have been observed in many animals within the tamer and raceway, but these are all superficial and easily treated.

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