EXPEDITION REPORT

Expedition dates: 11 – 18 January 2014

Report published: November 2014

Ways of the desert: conserving Arabian oryx, Gordon's wildcat and other species of the Dubai Desert Conservation Reserve, United Arab Emirates.

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Abstract

The successful collaboration between Biosphere Expeditions and the Dubai Desert Conservation Reserve (DDCR), initiated in 2012, continues. Citizen scientists collected data on nine target species, namely the Arabian oryx (*Oryx leucoryx*), Gordon's wildcat (*Felis silvestris gordoni*), mountain gazelle (*Gazella gazella*), sand gazelle (*Gazella leptoceros*), Arabian red fox (*Vulpes vulpes arabica*), sand fox (*Vulpes rueppellii*), Macqueen's bustard (*Chlamydotis macqueenii*), lappet-faced vulture (*Torgos tracheliotos*) and Pharaoh eagle owl (*Bubo ascalaphus*) for a week from 11 - 18 January 2014. Data gathered alerted the DDCR management to several conservation issues and also allowed for informed, fact-based management decisions to be made in a showcase of how the work of citizen scientist volunteers can aid the efforts of conservation professionals.

In 2013 Biosphere Expeditions monitored Arabian oryx herd health and found severe undernourishment. As a result, DDCR management increased supplementary feeding. In 2014, the expedition body scored 278 Arabian oryx for herd health again, resulting in an average score of 2.9, which is just below the fit and healthy score of 3.0. This is a highly satisfactory management result and body score monitoring will continue.

A total of 206 mountain gazelles and 159 sand gazelles were counted during the expedition. Since the majority of these are likely to be separate individuals, the numbers found for both species are alarmingly high. It is already evident that under current conditions the reserve cannot sustain the present oryx and gazelle populations without significant supplementary feeding. Furthermore, previous vegetation surveys have shown that the DDCR vegetation is already showing clear signs of overgrazing. Therefore a major management concern is the establishment of a gazelle carrying capacity for the DDCR, as well as self-sustaining control measures. Such control measures may in future include the removal of antelopes from the reserve through translocation and the introduction of an apex predator such as the Arabian wolf or hyaena to apply top down pressure to the antelope populations.

There were no live captures of Gordon's wildcats or feral cats during this expedition and no Gordon's wildcats were photographed by camera traps. However, there was a possible presence observed during the expedition in terms of tracks. It is difficult to assess whether the DDCR's Gordon's wildcat population is stable, increasing or declining and more trapping is needed to assess this. Major threats to the Gordon's wildcat in the DDCR are likely to be the availability of food, as well as hybridisation with feral cats.

A rare sand fox was caught by the expedition for the first time in the history of the DDCR, As a result of this capture, further expeditions will start targeting this species in an attempt to obtain more information about it.

Population modelling using the IDW (Inverse Distance Weighted Interpolation) and diversity indices methods show distributions in accordance with feed points and habitat preferences. Oryx populations are concentrated around the feed points, as are gazelles. Mountain gazelle distribution also follows their preferred stony/rocky habitat distribution.

The Macqueen's bustard population is small and very confined to specific areas of the DDCR. A small increase in numbers has been noticed. The lappet-faced vulture is seen fairly regularly as there is a good food source on the DDCR for them. The goal for both species is to have them breed in the reserve in future. Pharaoh eagle owl is a concern and numbers are on the decline, probably due to the scarcity of rain over the past few years, which has affected the vegetation and thereby rodents, which are the owl's primary food source.

الملخـــص العـــربى

مازال التعاون الناجح بين إدارة محمية دبى الصحراوية وبرنامج بعثات المحيط الحيوى مستمراً والذى بدأ مع العام 2012م حيث أستمر تجميع البيانات الحقلية بواسطة متطوعين من عامة الناس للعديد من الحيوانات البرية وهى (المها العربى، القط جوردون البرى، الغزال الأدمى، وغزال الريم والثعلب الأحمر وثعلب الرمال وطائر الحبارى والعقاب النوبى وكذلك البوم الصحراوى) وذلك لمدة أسبوع من كل عام وكان خلال أيام (11 إلى 18 يناير 2014م) حيث ساعدت البيانات المجموعة إدارة محمية دبى الصحراويةعلى إتخاذ قرارات بيئية ناجحة ساهمت فى تعزيز التعاون الناجح بين المتطوعين المهتمين بالبيئة والعاملين بالمحمية.

قام برنامج بعثات المحيط الحيوى فى عام 2013م بدراسة حالة قطعان المها العربى وخلص إلى نتيجة مفادها أن المها العربي يعاني من نقص حاد في التغذية وكنتيجة لذلك قامت إدارة المحمية بمضاعفة كميات العلف المقدمة لقطعان المها العربى لتعويض ذلك النقص فى التغذية.

قام فريق المتطوعين لبعثات المحيط الحيوى فى العام 2014م بدراسة وتسجيل عدد 278 رأس من المها العربى وذلك لتقييم الحالة العامة للمها مرة أخرى وكانت النتيجة تسجيل تحسن ملحوظ لعدد 209 رأس من المها العربى والتى دلت على حالة صحية وبدنية جيدة للمها مما كان له من أثار إيجابية لإدارة المحمية وسوف يتم الأستمرار بتسجيل البيانات الدورية لسنوات قادمة.

خلال فترة الدراسة تم تسجيل عدد 206 رأس من الغزال الأدمى وتسجيل عدد 159 رأس من غزال الريم وتبعاً لطبيعة توزيع الغزلان المنتشر فى كل أنحاء المحمية فأن تلك الأعداد تعد مؤشراً تحذيرياً للزيادة الكبيرة لأعداد الغزلان بالمحمية ولقد ثبت بالدليل القاطع انه تبعاً للظروف الراهنة من كثافة الغطاء النباتى فإن الكتلة الإحيائية النباتية فى المحمية لا يمكنها من توفير المرعى الطبيعى المناسب للحيوانات الرعوية البرية بالمحمية من غير التدخل البشرى بإمداد المحمية بالمزيد من الأعلاف. بالإضافة إلى ذلك، فأن الدراسات التقيمية للغطاء النباتى السابقة قد أثبتت تدهور الغطاء النباتى بالمحمية نتيجة للرعى الزائد ولذلك فأن الضرورة الملحة حاليا تقتضى تقييم القيم الرعوية لأراضى المراعى الجافة بالمناطق المحمية لمحمية دبى الصحراوية مع الاخذ فى الأعتبار التحكم فى معايير الإستدامة ومنها، التخلص من بعض أعداد قطعان المها والغزال عن طريق النقل للمحميات الأخرى والمزارع الخاصة أو إدخال حيوان مفترس رئيسى كالذئب العربى أو الضبع المخطط حتى يتم التحكم بصورة طبيعية فى أعداد قطعان الحيوانات البرية الرعوية.

لم يتم تسجيل القط جوردون البري أو أى من القطط الضالة فى أى من المصائد التى نصبت خلال تلك الفترة وكذلك من خلال مصائد الكاميرات ايضاً. بالرغم من ذلك، كان هناك إحتمالية للتواجد فى المنطقة من خلال كشف وتسجيل أثار أقدام تلك الحيوانات. كان من الصعب خلال تلك الفترة تقييم ثبات أعداد القط البري أو من حيث الزيادة أو النقصان وخلصت التوصية بزيادة أعداد المصائد المستخدمة فى السنوات التالية لتقييم أفضل للأعداد المحتمل تواجدها. خلصت الدراسة أيضاً إلى أن المهددات الحقيقية للقط جوردون البري هيا نقص الغذاء المتاح وكذلك عمليات التلقيح الخلطي بين القط البري والقطط الضالة.

تم تسجيل أول ثعلب رمال فى مصيدة من المصائد وذلك لأول مرة في تاريخ محمية دبي الصحراوية ونتيجة لذلك سوف يتم توجيه الأنتباه فى الرحلات الحقلية التالية لذلك النوع لدراسته بصورة مستفيضة وتسجيل أكبر قدر ممكن من البيانات عنه.

أظهرت نتائج توزيع الأنواع بإستخدام طريقة (بعد المسافات العكسي) لكل مناطق الدراسة وكذلك طرق مؤشرات التنوع الحيوى أن توزيع قطعان الحيوانات الرعوية البرية يعتمد على توزيع نقاط العلف وكذلك أفضلية البيئات لكل نوع على حدة، حيث تتركز توزيعات قطعان المها العربى وغزال الريم حول نقاط إمداد العلف أما بالنسبة للغزال الأدمى فالأفضلية لنوعية البيئات التى ينتشر بها والمناسبة لذلك النوع.

أثبتت الدراسات أن أعداد طيور الحبارى قليلة وتقتصر على مناطق محددة جداً بمحمية دبي الصحراوية ولقد تم ملاحظة زيادة طفيفة فى أعداد الحبارى بالإضافة إلى تسجيل مشاهدة العقاب النوبى بصورة منتظمة وذلك لتوافر الغذاء المناسب له فى المحمية. تهدف إدارة المحمية إلى تكاثر الحبارى والعقاب النوبى بصورة طبيعية فى المحمية فى المستقبل القريب. أما بالنسبة للبوم الصحراوى فأن أعداده فى نقصان ربما يرجع ذلك لقلة الأمطار فى الأعوام الاخيرة والتى أثرت بالسلب على الغطاء النباتى وبالتالى على أعداد القوارض والتى هى المصدر الأولى لغذاء البوم الصحراوى.

Contents

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

1. Expedition review

M. Hammer
Biosphere Expeditions

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Our projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Our expeditions are open to all and there are no special skills (scientific or otherwise) required to join. Our expedition team members are people from all walks of life, of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at www.biosphere-expeditions.org.

This expedition report deals with an expedition to the United Arab Emirates that ran from 11 to 18 January 2014 with the aim of assisting scientists of the Dubai Desert Conservation Reserve (DDCR) to gather scientific data on Arabian oryx, Gordon's wildcat, mountain and sand gazelle and Arabian red fox in order to gain a better understanding of their ecology so that informed management decisions can be made. Arabian oryx and Gordon's wildcat are on the IUCN Red list and the expedition's work will help to ensure the survival of the species in the wild. In gaining a better understanding of the Arabian oryx and Gordon's wildcat, through observations on their movements, habitat and food preferences and through their interaction with other species, this project is able to ascertain what the major threats are to their continued survival. Based on this, project scientists can then develop appropriate management plans that will provide a safe environment for the study species to thrive in.

1.2. Research area

The Dubai Desert Conservation Reserve (DDCR) is an area of 225 km² that comprises 4.7% of Dubai's land area. Conservation in this area started in 1999 when the Al Maha Desert Resort was opened within a protected area of 27 km² (Al Maha Reserve). One of the first conservation actions of the reserve was a wildlife reintroduction programme for Arabian oryx and the two indigenous gazelle species (sand as well as Arabian gazelle), as well as programmes for the protection of other key components of the ecosystem, in particular the vegetation (close to 6,000 indigenous trees were planted in 1999 to create a natural seed bank which has now led to germination of indigenous plants). In 2001 the resort management began a major environmental audit of the surrounding area. Following this audit a proposal was submitted to the Dubai government on the formation of a formal national park. The proposal was accepted and sanctioned almost immediately and work began on protecting the area to be known as the Dubai Desert Conservation Reserve.

Figure 1.2a. Flag and location of United Arab Emirates and study site.

An overview of Biosphere Expeditions' research sites, assembly points, base camp and office locations is at Google Maps.

Today the DDCR is a representative of the Dubai inland desert ecosystem and is characterised by a sandy desert environment consisting of sand dunes interspersed with gravel plains. There is one rocky outcrop in the north of the reserve, which provides nesting sites for the desert eagle owl and two groves of rare Ghaf trees (*Prosopis cineraria*). The Al Maha Reserve (27km²) was the core area for the reintroduction of the Arabian Oryx, Arabian gazelle and sand gazelle. Currently the DDCR contains approximately 450 Arabian Oryx from the 100 that were originally re-introduced in 1999. Both the Arabian Oryx and the gazelle species have expanded into the DDCR naturally as the amount of human activity has decreased and been controlled. Arabian and sand gazelle can now be seen throughout the DDCR.

1.3. Dates

The expedition ran from 11 - 18 January 2014 and was composed of a team of international research assistants, guides, support personnel and an expedition leader (see below for team details).

1.4. Local conditions & support

Expedition base

The expedition field base was composed of a Bedu style tent camp (of a Bedu mess tent and modern one and two person dome tents for sleeping in). Each person had their own dome tent to sleep in (larger tents for couples) and there were campsite-style showers and toilets. An expedition cook, kindly provided by Al Maha was with the team and cooked in the field. Vegetarians and other special diets were catered for. Groceries and fresh organic produce were kindly provided by Al Maha and Ripe.

Weather

The UAE has a subtropical, arid climate with sunny blue skies most of the year. Over the eight days of the expedition the weather was unusually wet with grey skies. Towards the end of the expedition the weather cleared and once again it was sunny with blue skies. The mean low and high temperatures during the expedition were 12º and 26º C. Most mornings there was fog cover, which lifted by 09:30.

Field communications

There was an (emergency) telephone close to base and mobile phones will largely worked in and around camp and around the study site. In the field, two-way radios and mobile phones were used for communication between research teams.

The expedition leader also posted and expedition diary on Biosphere Expeditions' social media sites such as Facebook, Google+ and the Wordpress blog.

Transport and vehicles

Team members made their own way to the Dubai assembly point in time. From there onwards and back to the assembly point all transport and vehicles were provided by Biosphere Expeditions and the DDCR for the expedition team, for expedition support and emergency evacuations.

Medical

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. A network of first-rate private and government hospitals in Dubai provided further medical support. Safety and emergency procedures were in place. There were no medical incidences during the expedition and none of the medical support network or safety procedures were called upon.

1.5. Scientists

The expedition's field scientist is Stephen Bell. Born in South Africa, he graduated in Biology in 1996, with a bachelor's degree from the University of Witwatersrand, South Africa. Stephen spent most of his career guiding throughout South Africa and Zambia in private game lodges. He was also a trails guide in the greater Kruger National Park where he conducted 5 day walking safaris. Stephen fell in love with the fauna and flora of the Arabian desert whilst he spent six years guiding in the area at the Al Maha Desert Resort & Spa. Stephen joined the DDCR as a Conservation Officer in 2009 and works closely with on-going conservation projects on the reserve. Stephen has a passion for birding and is always keeping an ear out for the odd bird call. Stephen has always had a keen interest in wildlife from a young age he was always found playing with all sorts of creepy crawlies. During his off time Stephen can be found with mates diving around the world.

Greg Simkins, who is South African by birth, is the Conservation Manager for the Dubai Desert Conservation Reserve (DDCR) and has worked in the field of conservation and protected areas management since 2001. Greg began his career as a field guide in 1999. In 2001 he became a Reserve Officer in the DDCR and was heavily involved in the planning and implementation of eco-tourism activities within the protected area, which was created in 2003. In 2003 Greg took on his current role and was appointed Conservation Manager for the DDCR. He is now responsible for the overall management of the Reserve and has been at the forefront of its development from conception in 2003 to its current international recognition. He also plays a major role in conducting key conservation research studies throughout the DDCR. Prior to coming to the Middle East, Greg studied at the University of Natal, Pietermaritzburg in Kwazulu-Natal, where he also did graduate work while, including resource assessment and allocation for a farm, soil surveys and research at an ostrich export farm in the Eastern Cape.

1.6. Expedition leader

Malika Fettak is half Algerian, but was born and educated in Germany. She majored in Marketing & Communication at the University of Frankfurt, which led her to jobs in PR & Communications. She has travelled widely, especially in Africa and Northern Europe. Her love of nature and the outdoors, and taking part in a few Biosphere expeditions, persuaded her that a change of career was in order and here she is since 2008, leading expeditions and making herself useful around the office. Malika is a keen sportswoman - triathlon, skiing, volleyball, etc. and enjoys the outdoors.

1.7. Expedition team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds. They were (in alphabetical order and with countries of residence):

Bojana Knezevic (Canada), Branko Budisin (Canada), Martin Etter (Switzerland), Patrick Jean-Martel (France), Paul Sanger (USA), Trevor Sims (UK), Tricia O'Brien (Canada), Yvonne Raap (Switzerland).

1.8. Partners

The main partner on this expedition is the Dubai Conservation Board, a government-appointed organisation concerned with the conservation and protection of the Dubai inland desert. Other partners include the National Avian Research Centre. Corporate support was gratefully received from Ripe, who supplied fresh, local organic produce and from Al Maha, Desert Resort & Spa, who provided a chef and food.

1.9. Expedition Budget

Each team member paid towards expedition costs a contribution of £980 per seven-day slot. The contribution covered accommodation and meals, supervision and induction, all maps and special non-personal equipment, all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses such as telephone bills, souvenirs, etc., as well as visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how these contributions were spent are given below.

Income	£
Expedition contributions	7,840
Expenditure	
Staff includes local & international salaries, travel and expenses	1,616
Research includes equipment and other research expenses	825
Transport includes car hire, fuel, taxis and other local transport	1,342
Base includes food and camping fees	111
Administration includes local sundries and fees	56
Team recruitment Arabia as estimated % of PR costs for Biosphere Expeditions	4,472
Income – Expenditure	**- 582**
Total percentage spent directly on project	**107%***

*This means that in 2014, the expedition ran at a loss and was supported over and above the income from the expedition contributions and grants by Biosphere Expeditions.

1.10. Acknowledgements

This study was conducted by Biosphere Expeditions, which runs wildlife conservation expeditions all over the globe. Without our expedition team members (listed above) who provided an expedition contribution and gave up their spare time to work as research assistants, none of this research would have been possible. The support team and staff (also mentioned above) were central to making it all work on the ground. Biosphere Expeditions would also like to thank the DDCR and its staff, Al Maha, Ripe and the Friends of Biosphere Expeditions for their sponsorship and/or in-kind support.

1.11. Further information & enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org.

Copies of this and other expedition reports can be accessed via at www.biosphere-expeditions.org/reports. Enquires should be addressed to Biosphere Expeditions via www.biosphere-expeditions.org/offices.

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2. Desert species surveys

2.1. Introduction and background

The United Arab Emirates, and Dubai in particular, is well known for its rapid development over the past 40 years, as well as for the mega-construction projects such as the Palm Islands and the Burj Khalifa (the world's tallest building). Less well known is the diversity and beauty of the natural environment, from the dugongs and corals in the Arabian Sea, the flamingos in the khors (inlets) of the coastline, the rugged Hajar mountain range, to the serene splendour of the sandy dune inland desert. Also little known is that the largest piece of land given to any single project in Dubai was for the establishment of the Dubai Desert Conservation Reserve (DDCR), at 225 km² or 4.7% of Dubai's total land area.

Arabian oryx (*Oryx leucoryx*) is one of four oryx species, all of which are adapted to arid and semi-arid environments. Locally known by its Arabic name of Al Maha, the Arabian oryx was first described in 1777. Endemic to the Arabian Peninsula, the Arabian oryx's historical range was across Oman, Saudi Arabia, Jordan, United Arab Emirates, Yemen, Kuwait and Iraq, but the advent of firearms saw their rapid decline due to hunting all across Arabia. Since 1986 the Arabian oryx has been classified as "Endangered" on the IUCN Red List, but was already "very rare and believed to be rapidly decreasing in numbers" in 1965. The Arabian oryx is the largest of the antelopes in the region and it is very well adapted to the extremely arid environment. It is culturally significant in Arabia, revered for its beauty, common in poetry and as a woman's name, Maha. Re-introduced into the DDCR in 1999, the population has steadily grown from the original 100 individuals to over 400 today.

Figure 2.1a. Arabian oryx (photo courtesy of S. Bell),

The Arabian oryx is a medium-sized antelope with a distinct shoulder bump, long, straight horns, and a tufted tail; it is a bovid, and the smallest member of the oryx genus, native to desert and steppe areas of the Arabian Peninsula. The Arabian oryx was extinct in the wild by the early 1970s, but was saved in zoos and private preserves and reintroduced into the wild starting in 1980. Arabian oryx prefer to range in gravel desert or hard sand, where their speed and endurance will protect them from most predators, as well as most hunters on foot. In the DDCR they are found in the hard sand areas of the flats between the softer dunes and ridges. The diet of the Arabian oryx consists mainly of grasses, but they will eat a large variety of vegetation, including trees, buds, herbs, fruit, tubers and roots. Herds of Arabian oryx are known to follow infrequent rains to eat the new plants that grow afterward (Talbot 1960).

For the next phase of the DDCR's oryx project, local scientists need a greater understanding of how oryx fit into the DDCR's natural environment, which habitats and plants they prefer, what the social structure of the herd is and how the species is affected by its environment. This can only be achieved through monitoring and keen observation for extended periods. Biosphere Expeditions provides the manpower to complete this task that will help the DDCR achieve its ultimate goal of a sustainable herd of Arabian oryx within the reserve.

The **Gordon's wildcat (*Felis silvestris gordoni*)** is the same size as a domestic cat. The background colour of its coat ranges from reddish to sandy yellow to tawny brown to grey, and is typically marked with faint tabby stripes and spots. Its preferred habitat is the vegetated dunes, gravel plains and mountains, in which it hunts a mainly carnivorous diet at night. It is thinly distributed throughout the Nubian, Saharan and Arabian deserts, where it is generally restricted to mountains and dry watercourses. The biggest threat to the survival of the Gordon's wildcat as a species is the interbreeding with feral or domestic cats, which could lead to its extinction as a distinct species. Very little is known about the Gordon's wildcat population within the DDCR. The last population estimate was done in 2004. The expedition has enabled DDCR scientists to update information on population size and distribution as well as conduct a DNA study of the species; information that is important for informed management decisions to be made and threats to be averted.

Figure 2.1b. Gordon's wildcat (photo courtesy of P. Roosenchoon).

The **mountain gazelle (*Gazella gazella*)** has a delicate body of 10 to 14 kg and can reach speeds of 65 km/h if it needs to escape danger. The mountain gazelle has a pure white belly with a dark to black stripe on its flanks that changes to dark beige or brown on the back, the neck and the head. The facial markings consist of various shades of brown with two white stripes extending from the eyes towards the nostrils. Females can give birth to a single fawn during any month, but with natural peaks in spring and autumn. Most grazing activity takes place at dawn and dusk. It rests during the hottest hours of the day under any shelter available, which may be a cave for those that inhabit the mountains. Usually moving in small groups of four to six animals, the species is highly territorial, with the dominant male continuously marking its territory with a wax-like substance, which it produces in glands below the eyes. The substance is deposited by rubbing its head against a bush, a branch or a stone. The group also maintains several places within its territory which they establish as "toilets". The animals usually only defecate and urinate at these sites. As with oryx and sand gazelle, mountain gazelles do not need to drink water, but will readily do so if water is available (Grubb 2005).

Figure 2.1c. Mountain gazelle (photo courtesy of S. Bell).

The **sand gazelle's (*Gazella leptoceros*)** elegantly curved horns of both males and females are considerably longer than those of other gazelles occurring in the area. The animals are very light in colour, the head completely white in older animals, with back and flanks light beige. The belly is white and there is no darker stripe between the white underside and the beige flanks and back of the gazelle. Contrasting with the overall pale body, are the black eyes, nostril and mouth. Their colouring is obviously an adaptation to the habitat they favour, which are the open sands. They are absent from the mountains. The sand gazelle is the only antelope in this area that regularly gives birth to twins, and this usually in spring and autumn. The young spend their first days in shallow scrapes, or under a small bush, until they are strong enough to move with the adults (UAEInteract 2012).

Figure 2.1d. Sand gazelle (photo courtesy of G. Simkins).

The **Arabian red fox (*Vulpes vulpes arabica*)** is widespread in the region. Highly adaptable, it inhabits virtually every environment and lives in the cities along the coast, the desert and the mountains. However, it does not seem to penetrate areas such as the Liwa with soft sand and high dunes. An omnivorous animal, it will eat almost anything, from dead fish on the beach, to dates, carrion and of course small mammals and birds, which it actively hunts during the night. The cubs, numbering up to six per litter, are raised in a burrow that the vixen excavates herself and often uses year after year. Cubs are born in early spring, fully furred but blind and their eyes open after about 10 days. At the age of four weeks they start taking solid food and this is also the time when they begin exploring the surroundings of their burrow. Soon after this they follow the vixen on short hunting trips. As it lacks the long dense fur of the European fox, Arabian fox appears to have a thin body and long legs, but proportionally they are the same, with the exception of the ears. These are larger and have thousands of tiny blood vessels that help the Arabian fox to maintain its body temperature. Reddish to sandy-brown, its colour has adapted to the environment in which it is living (Harrison and Bates 1991, Hellyer 1993).

Figure 2.1e. Arabian red fox (photo courtesy of J. Babbington).

The **sand fox (*Vulpes rueppellii*)**, also know as Ruppell's, Rueppell's or Rüppel's fox, is a species of fox living in North Africa and the Middle East, from Morocco to Afghanistan and the southwestern parts of Pakistan. It has an average life expectancy of up to six or seven years in the wild, but can live longer in captivity. Sand foxes are about 40-52 cm long and have an average weight of 1.7 kg. It is a very small canine, and is considerably smaller than the red fox. It is sandy in colour and has black patches on the muzzle, as well as a white-tipped tail. The sand fox relies on scent glands for many activities. It uses them to mark territories as well as to spray unwanted predators, similar to the behaviour of the skunk. The female sand fox uses her scent glands to mark the cubbing den. Another use for the scent glands is that the foxes use them to greet each other. Sand foxes can bark, in a way similar to a dog. During the mating season, they travel in monogamous groups, or a male and a female, but after the breeding season, the fox reportedly moves in family groups of 3-15 individuals (Wikipedia 2014). One animal occupies about 50-69 km^2 of territory, with the male's territory larger than that of the female. The sand fox is nocturnal and gregarious. Animals change dens often, and will abandon a den if there is a dangerous disturbance in the area. Most dens are dug under rocks or under trees.

The sand fox was pushed to living in the desert biome due to competition with its larger cousin, the red fox. It is known as being an extremely good survivor. It is is preyed upon only by the steppe eagle and the eagle owl. A solitary forager and omnivore, it will eat almost anything that crosses its path. Mostly, it is an insectivore, but its diet also consists of tubers and roots, as well as small mammals, reptiles, eggs, and arachnids. The female sand fox has a gestation period of around 51–53 days. She has 2-3 kits, and each is born blind. They are weaned at 6–8 weeks of age. They are born underground, to protect them from predators.

Figure 2.1f. Sand fox.

The **Macqueen's bustard (*Chlamydotis macqueenii*)** is a large bird in the bustard family. It breeds in southwestern Asia, in deserts and other very arid sandy areas. It is brown above and white below, with a black stripe down the sides of its neck. In flight, the long wings show large areas of black and brown on the flight feathers. Sexes are similar, but the female is smaller and greyer above. The Macqueen's bustard has recently been split as a separate species from the Houbara bustard (*Chlamydotis undulata*) of the Canary Islands and North Africa. These two species are the only members of the *Chlamydotis* genus (Ali 1993). The dividing line between the two species is the Sinai Peninsula. Macqueen's has a greater tendency to wander than the more sedentary Houbara bustard. Both species have been hunted to near-extinction. Conservation efforts by the late Sheikh Zayed bin Sultan Al Nahyan in the UAE have given some hope for the future of the Macqueen's bustard.

Figure 2.1g. Macqueen's bustard (photo courtesy of S. Bell).

The **lappet-faced vulture (*Torgos tracheliotos*)** is a mostly African Old world vulture belonging to the bird order Accipitriformes, which also includes eagles, kites, buzzards and hawks. It is usually found in undisturbed open country, at elevations from sea level to 4,500 m (Ferguson-Lees & Christie 2001), with a scattering of trees and apparently prefers areas with minimal grass cover. While foraging, it can wander into denser habitats and even into human habituated areas, especially if drawn to road kills. The species is fairly rare in the UAE, but good sightings have been made in the DDCR and it is the best place in the UAE to find the species. It is hoped it will start to nest in the DDCR in the near future.

Figure 2.1h. Lappet-faced vulture (photo courtesy of S. Bell).

The **Pharaoh eagle owl (*Bubo ascalaphus*)** or desert eagle owl was heard every evening around the camp. These owls can be found in rocky deserts and semi-deserts, gorges, cliffs, rocky mountain slopes. During the day they are mostly seen sleeping under fire bushes (*Leptadenia pyrotecnica*) and will take flight if disturbed.

Figure 2.1i. Pharaoh eagle owl (photo courtesy of S. Bell).

2.2. Methods

Expedition participants assisted DDCR scientists in three important surveys: Gordon's wildcat live capture and camera trapping, as well as Arabian oryx monitoring. In addition to these surveys the expedition members were tasked to record any species observation or encounters while in the field. After a 1.5 days training period, participant were split into three groups to conduct the various surveys, in three separate zones of the DDCR, namely a North Zone, Central Zone and South Zone (see Figure 2.2a). Each zone comprised fourteen 2 x 2 km quadrants. These 42 quadrants together equate to 168 km² of the 225 km² of the DDCR (or 75%). The area includes all key habitats of vegetated dunes, sand dunes and gravel plains.

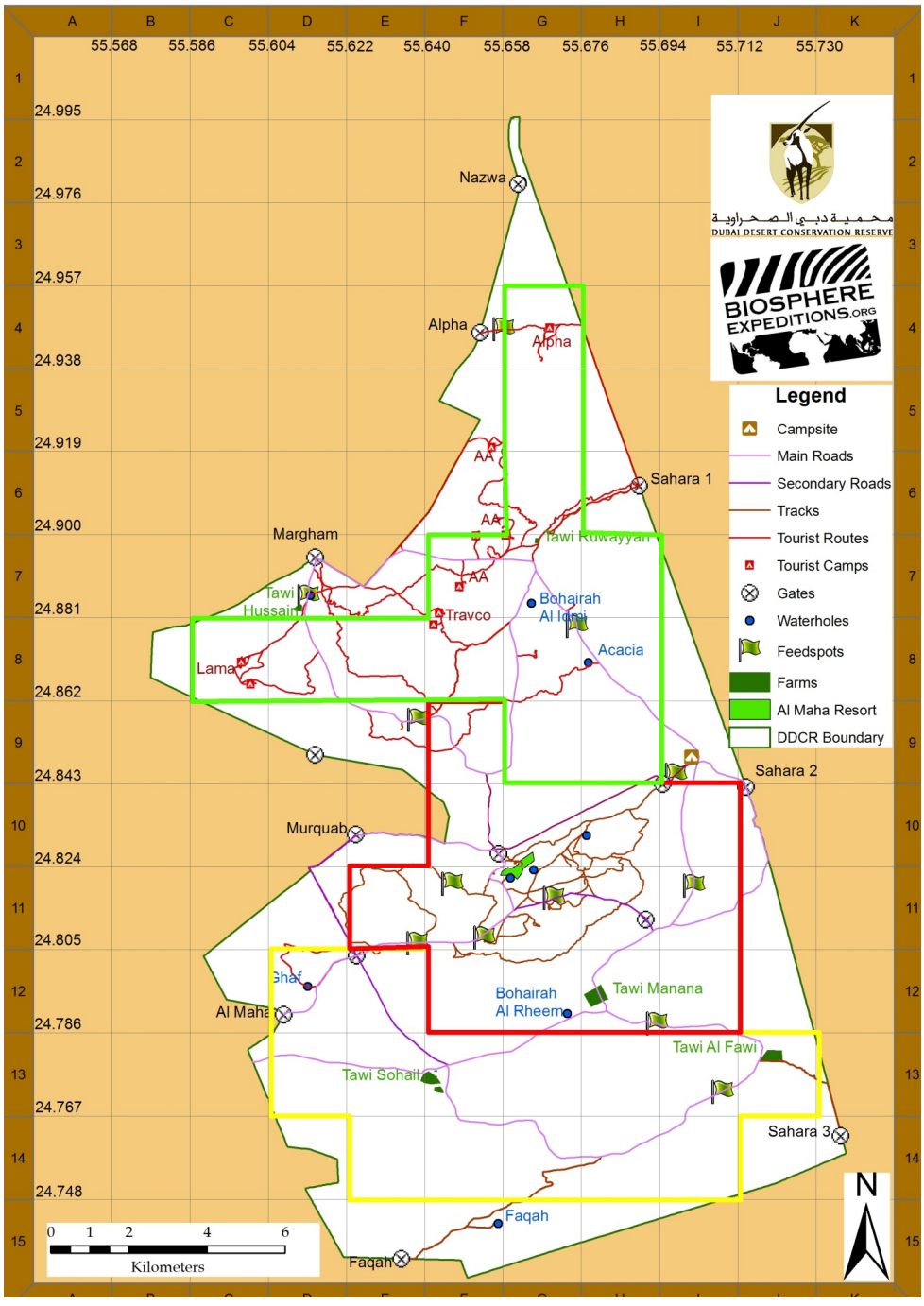

Figure 2.2a. The DDCR and its survey zones (North = green, Central = red, South = yellow).

Expedition participants were split into three groups and each person moved between zone survey groups so as to experience all habitat types of the reserve. Every day each group was tasked to survey three quadrants or 12 km². 180 km² were covered in this way during the expedition. During surveys any target species encounters were recorded in the relevant datasheets. Datasheets also included oryx body condition scoring.

Oryx body condition scoring

Body condition scoring is a method to provide measurable, quantitative and informative indicators of the fitness of the DDCR's Arabian oryx herd. The body scoring method used by the expedition was modified from El Alqamy, (2010), using the dairy cattle body condition scoring developed by the University of California's (Davis) veterinary medicine extension. The method is based on visual assessment of the back posture of the animal and defining the body condition score according to presence or absence of some features such as musculature, fat deposition, spinal vertebrae and caudal vertebrae. There are six integer scoring grades (see appendix 1).

Oryx behaviour observations

Oryx behaviour was recorded after each group had completed the body condition scoring. Members of each group observed the oryx and recorded what the individuals were doing (see Figure 2.2b). This was done until the herd stopped displaying new behaviours over 30 minutes. For example, if the oryx started resting in the shade and did not look like they were moving on, the team would move on to find the next herd. The following parameters were recorded in the datasheets: time, quadrant, distance from observer to the animal, recorder's position, behaviours such as moving, grazing, chasing, resting, fighting and mating, additional comments.

Figure 2.2b. Oryx body scoring & behavioural observations using a spotting scope (photo courtesy of Wouter Kingma).

Species encounters

Target species as described above and encountered during the surveys were recorded in the datasheets as follows: what species was seen, position of researcher when the species was first seen, distance and bearing from researcher to target species, time of day when the species was observed, ecological information such as number of animals, sexes etc., additional comments.

IDW (Inverse Distance Weighted Interpolation)

Interpolation is a procedure used to predict the value of cells at locations that lack sampled points. One of the most commonly used techniques for interpolation of scatter points is inverse distance weighted (IDW) interpolation (ESRI 2009) Inverse distance weighted methods determine cell values using a linear-weighted combination set of sampling points and based on the assumption that the interpolating surface should be influenced mostly by the nearby points and less by the more distant points. The interpolating surface is a weighted average of the scatter points and the weight assigned to each scatter point diminishes as the distance from the interpolation point to the scatter point increases.

IDW was used as a method to predict the specie distribution patterns of species recorded in the DDCR during the expedition's surveys. Abundance counts over the study area were used as input and predictions were applied to all the species recorded using ESRI® Arc Map 10.0 spatial analyst extensions.

Live traps

Nine Tomahawk live traps were used during the expedition for the purpose of capturing Gordon's wildcat. At the beginning of the expedition, each survey group was given three live traps to place within their allocated zones. In each zone three pre-allocated quadrants were given to each group to decide where within the quadrants they should place each live trap. Each group marked the position of the live trap in the GPS and the live traps were left out in the field for the five nights. The traps were baited with tinned sardines. The bait was placed right at the back of the trap (using an extendable reacher/grabber) (see Figure 2.2c) so the target species is forced to step onto the pressure plate. The pressure plate was covered with sand to give the trap a more natural feel and to ensure that the target species is at ease when entering the trap.

Each morning groups set out into their zones to check each of their three live traps. This involved checking the surroundings of the traps for a possible presence/absence around the trap and to see if the trap had been disturbed or investigated by a Gordon's wildcat or a feral cat. Data gleaned in this way was entered into datasheets. Where necessary, traps where re-baited.

Figure 2.2c. Bating a live trap.

Camera trapping

Figure 2.2c. Setting a camera trap (photo courtesy of Wouter Kingma).

As many species in the desert environment are both nocturnal and elusive, it is difficult to gather reliable information on their populations. A camera trap triggers when an animal passes in front of and infrared and/or motion detector. This has the advantage of detecting, with equal efficiency both nocturnal and diurnal activities with minimal environmental disturbance. The camera trap survey aims to record the presence (or absence) of elusive and nocturnal species, in particular the smaller carnivores, within the DDCR.

Six camera traps (two Bushnell Trophy Cams and four Reconyx RC60) were used during the expedition two in each zone. Predetermined quadrants in each of the zones were chosen for the survey groups to set their camera traps in, close to water sources. The traps were baited on the first day with quail guts and left out in the field for five days. All camera traps were collected on the last day of the expedition.

Diversity indices

Diversity indices are used to asses quantitatively the diversity of faunal communities and to compare different habitats. Many quantitative indices have been developed by landscape ecologists to measure the spatial and temporal changes of species and habitat richness and biodiversity, for example Khafaga (2009)

The Shannon diversity index is a very widely used index for comparing diversity between various habitats. It assumes that individuals are randomly sampled from an independently large population (Peet 1974).

The Brillouin diversity index is used when diversity of non-random samples or collection is being estimated. As the Shannon diversity index, Brillouin is type I index, which means it deals with the rare species in the community (Peet 1974).

The Simpson diversity index is a type II index and as such gives more weight to the abundant species in the sample. It takes into account the number of species present, as well as the abundance of each species. The index represents the probability that two individuals randomly selected from a sample will belong to different species. The value ranges between (zero and one), and the greater the value, the greater the sample diversity (Peet 1974).

IDW was used as a method to predict the species distribution patterns of species recorded in the DDCR during the expedition's surveys. Abundance counts over the study area were used as input and predictions were applied to all the species recorded using ESRI® Arc Map 10.0 spatial analyst extensions.

2.3. Results

Oryx body condition scoring

The Biosphere Expeditions survey of January 2013 found an average oryx body score of 2.2. (Bell et al. 2013 and Figure 2.3a), which is classed as 'poor condition'. This gave rise to concern and, following the expedition, the DDCR conducted another survey in May 2013, which yielded an average score of 1.1 or 'extremely poor condition' (see Figure 2.3a). As a result of these two surveys, the feeding supplementation programme was changed and the feed doubled, because it was found that the natural vegetation present in the reserve could not sustain the high number of oryx present therein. The increase in feed resulted in the recovery of the population to body score 2.9, as found by this study, which is just below the 'fit and healthy' score of 3.0 and above.

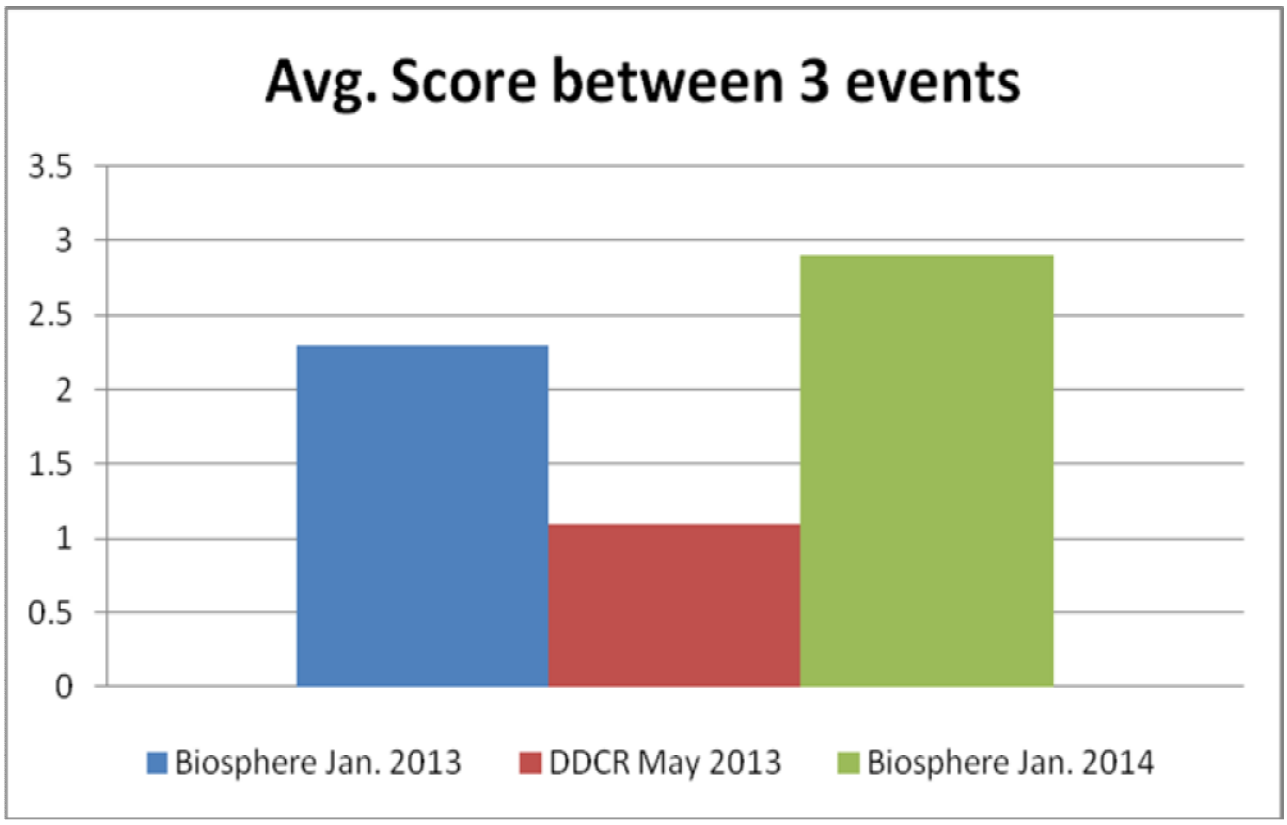

Figure 2.3a. Comparison of average oryx body scores over time and three assessments.

Out of the twelve herds that were found in the field; only ten were recorded, as herds N6 and S7 ran away as they were approached by surveyors (Figure 2.3b). Overall the majority of individuals in each herd scored 3.0 or above, with some older individuals towards the end of their lives scoring around 2.0, thereby bringing down the average to just below 3.0. This is a result close to ideal natural conditions and shows the success of the changed feeding regime.

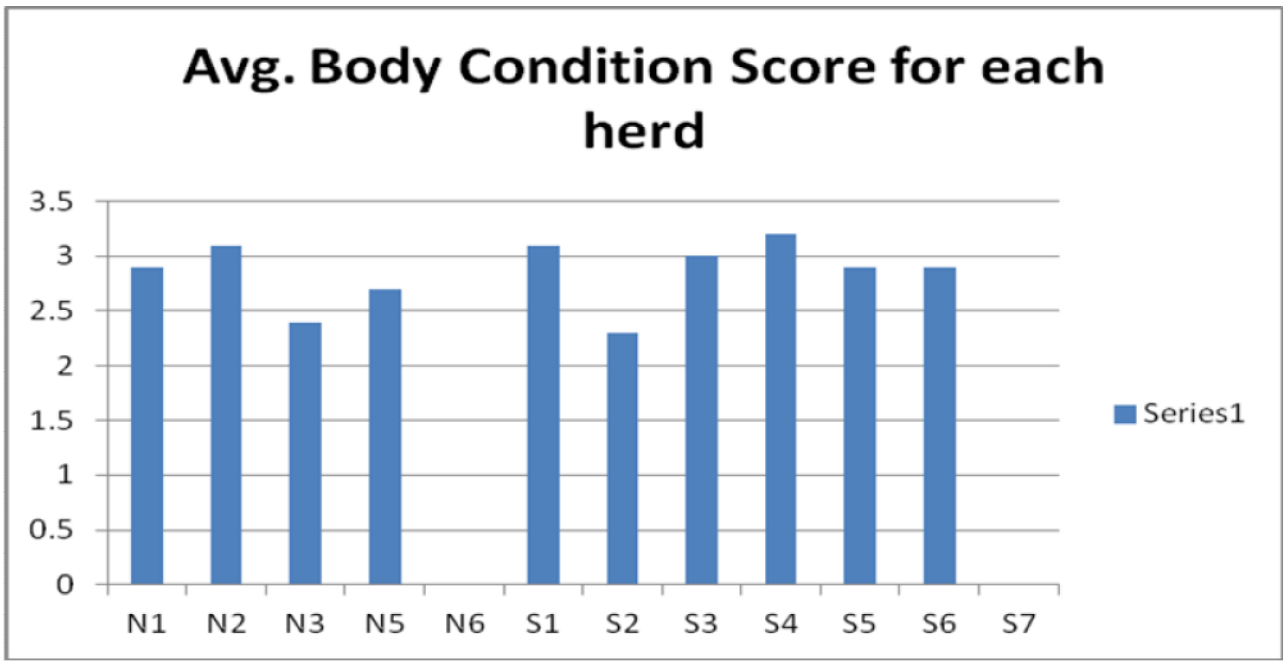

Figure 2.3b. Comparison of average oryx body scores by herd for January 2014.

A somewhat surprising result was the equal body scores of males and females (Figure 2.3c). We expected the male average score to be higher as they are usually more dominant around the feeding stations and tend to bully other members (particularly females and juveniles) of the herd who then display lower body scores as they did in January 2013 (Figure 2.3d). The equal scores suggest that the males are getting sufficient food and then move off allowing the rest of the herd to feed. As feed portions were doubled, there appear to be adequate amounts of feed left for the rest of the herd.

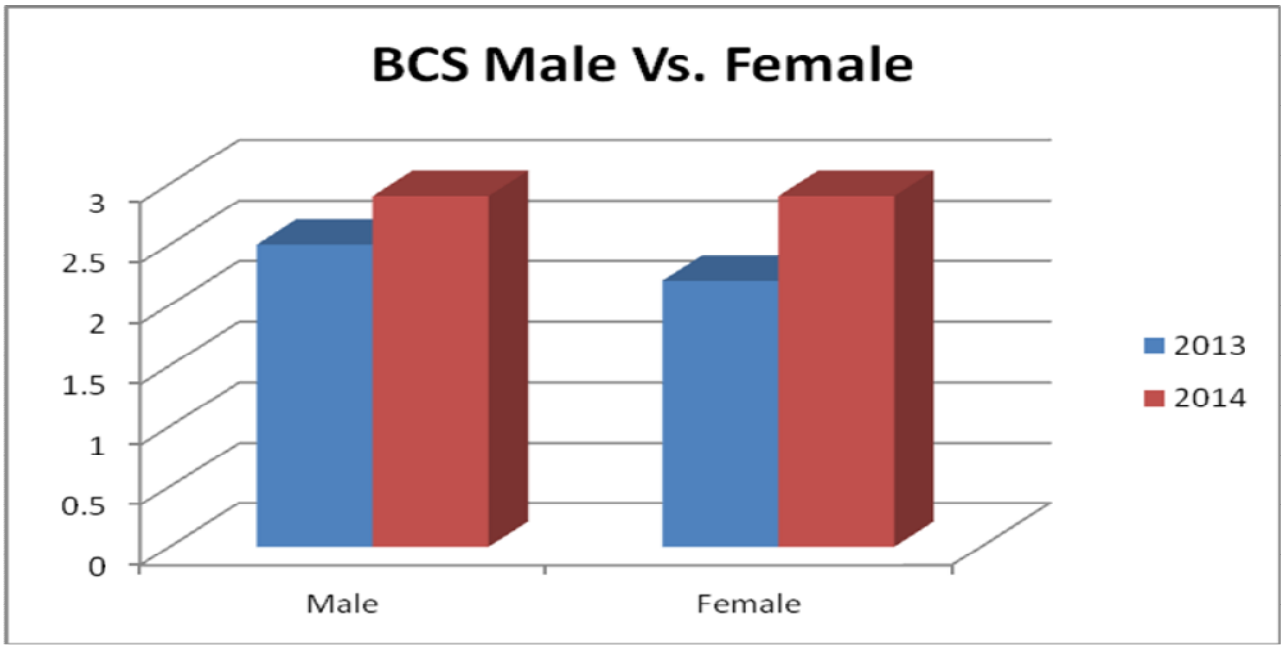

Figure 2.3c. Comparison of male vs. female oryx body scores for January 2014.

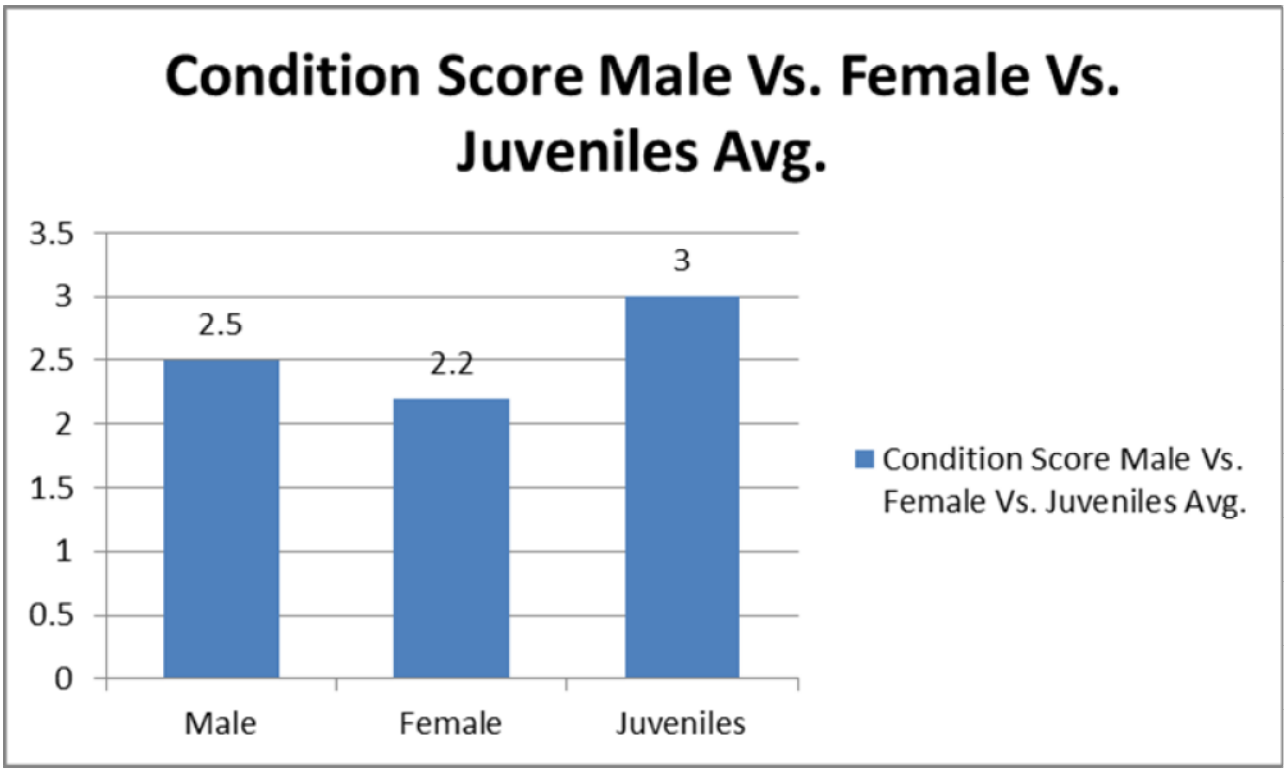

Figure 2.3d. Comparison of male vs. female vs. juvenile oryx body scores for January 2013.

In total 98 oryx were assessed (43 male, 38 female, 4 juvenile, 13 of unidentified sex). Another three oryx were counted, but body condition score could not be reliably identified. From the 21 groups that were recorded, 17 were recorded in the North Zone, two in the Central Zone and two in the South Zone.

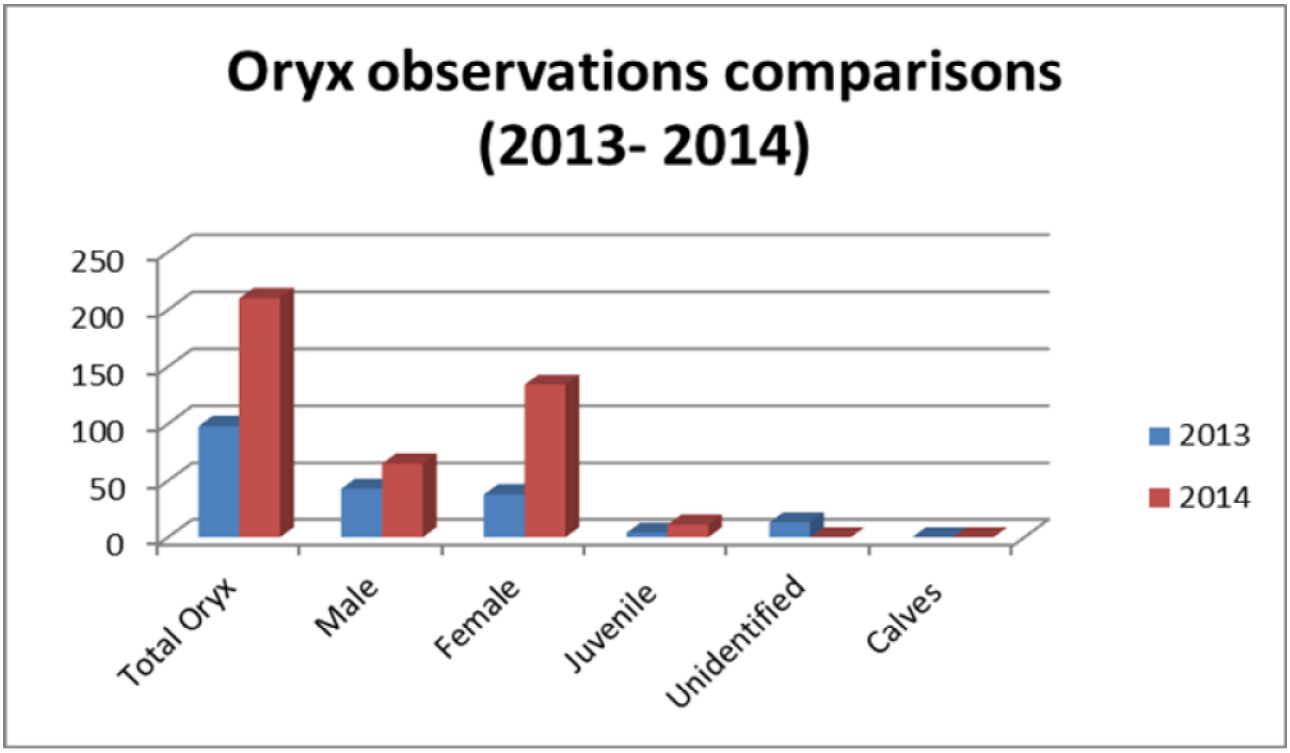

Figure 2.3e. Comparison of 2013 vs. 2014 oryx observations.

There are fixed feeding stations and random feed drop points within the DDCR. At feeding stations oryx are almost always present at certain times of the day. Two of these feeding stations are in the North Zone, with one of them in the survey area. In the Central Zone there are three feeding stations all three of which are in the survey area. In the South Zone there is one feeding station, which is in the survey area. Survey teams concentrated on feeding locations in order to find animals and get close to them for body scoring. Animals in the Northern and Central Zones are by and large habituated to human presence. In total 210 oryx were assessed (65 male, 134 female, 11 juvenile and 0 calves). From the ten herds that were encountered, four were recorded in the North Zone and six in the South Zone. For this year's expedition the Central and South Zone were combined as one zone while counting oryx, because feeding stations had been placed in those two zones by reserve management

Oryx behaviour

Oryx behaviour was observed in 13 out of the 42 or in 31% of quadrats. This is the same overall total as in 2013, but with different zone totals (see Figure 2.3f).

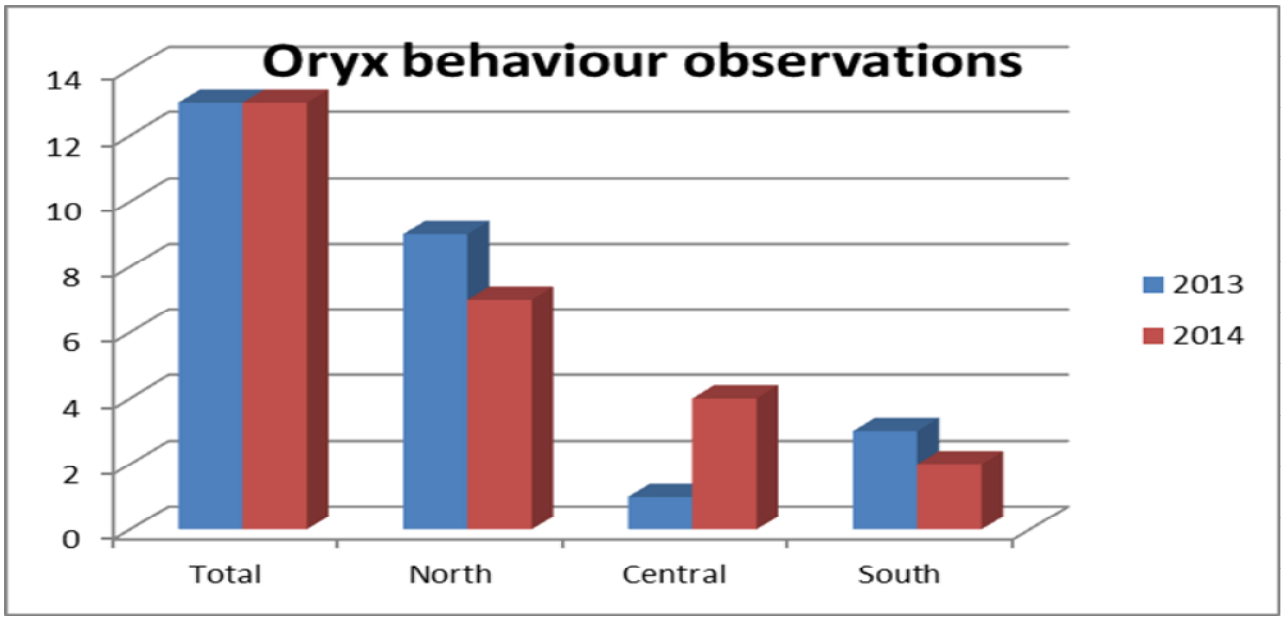

Figure 2.3f. Comparison of 2013 vs. 2014 oryx behaviour observations.

The different oryx activities (moving, grazing, chasing, resting, fighting and mating) show no difference between mornings and afternoons with the exception of resting, which was favoured in the mornings (Figures 2.3g & h). Fighting was noticed only once and it took place in the afternoon. Zero mating activity was observed because the mating season is during June and July.

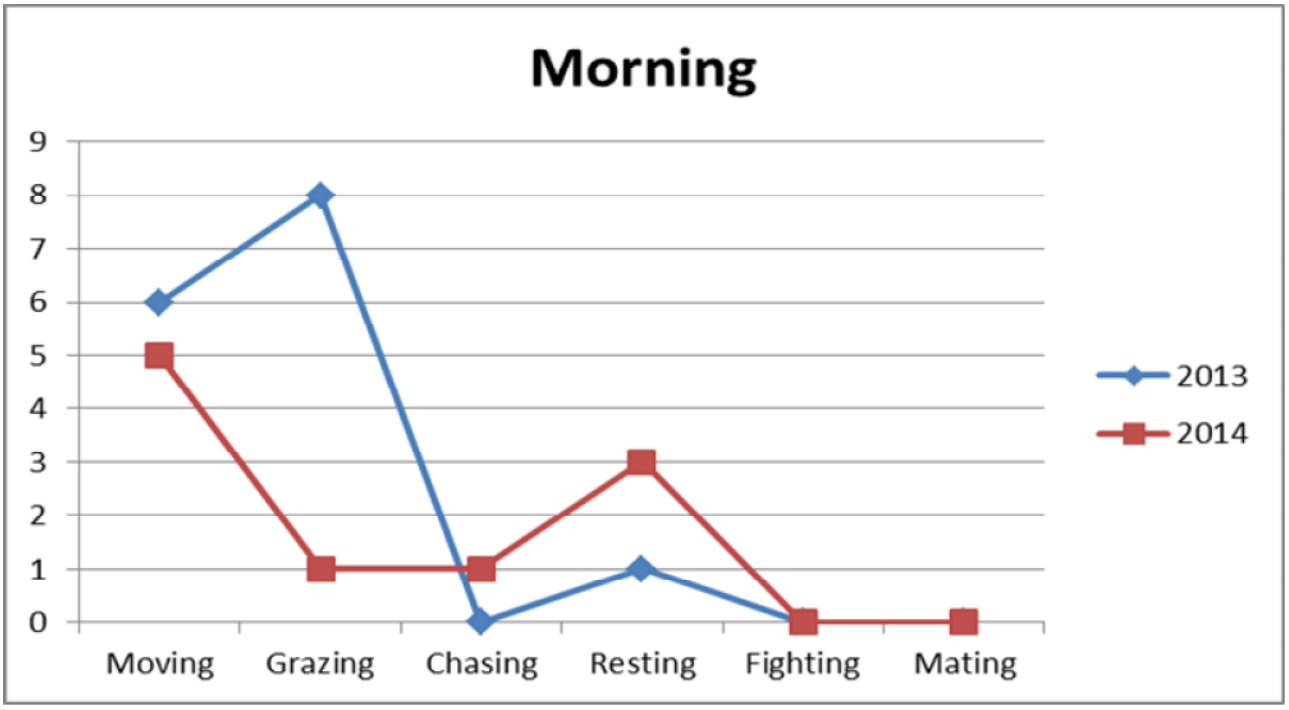

Figure 2.3g. Oryx behaviours recorded by the expedition during the morning.

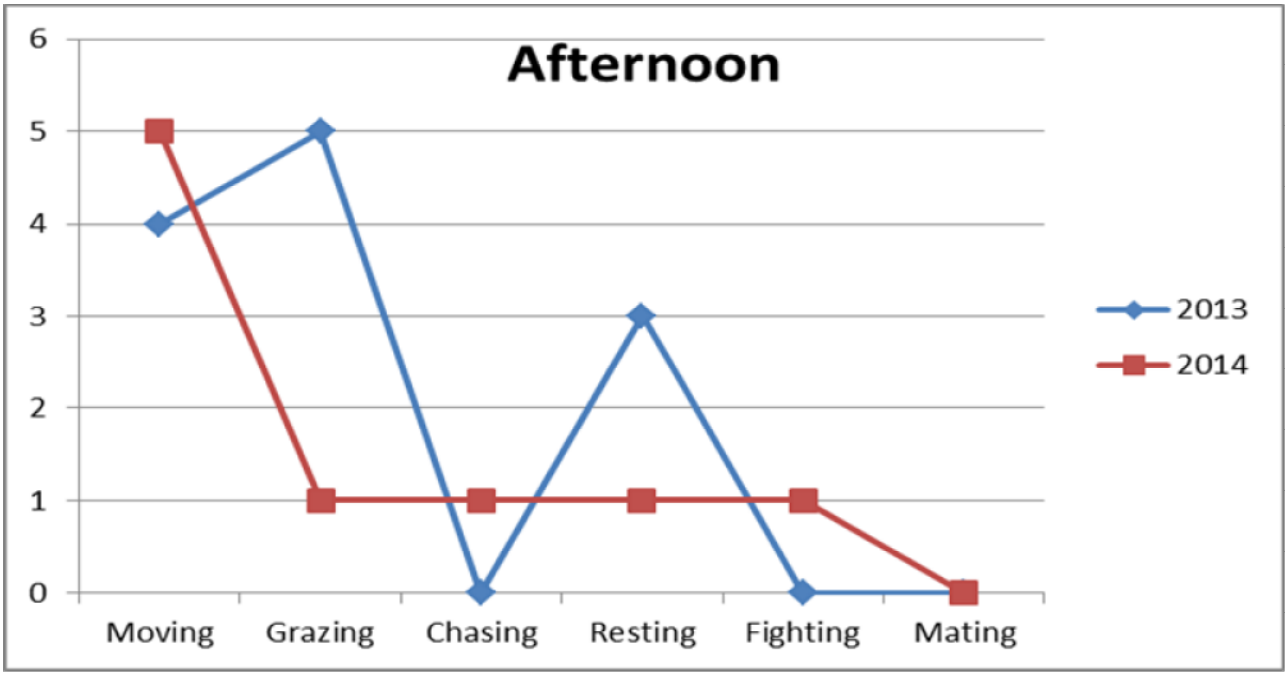

Figure 2.3h. Oryx behaviours recorded by the expedition during the afternoon.

Species encounters

A wide range of species was observed during the six survey days of the expedition (Table 2.3a). Five mammal species were observed, one more than in 2013. The new species in 2014 was the extremely rare sand fox, which was captured in one of the live traps (Figure 2.3i). It is the first time that this species has been captured in the DCCR, where they have been seen before, but never captured.

Thirty-one bird species were recorded. Of the target bird species, eleven lappet-faced vultures were seen in two separate sightings. A group of ten, which was seen early in the morning, circling above and sitting on the dunes. There was no sign of a carcass, so the birds had most likely roosted on the dunes that night and were disturbed when the expedition participants approached. The second sighting was late in the morning when one individual was seen utilising the thermals.

Pharoah eagle owls were seen twice, both in the northern part of the reserve.

Macqueen's bustards were observed only five times. This is a surprisingly low number and it will be interesting to compare next year's records with 2014.

Table 2.3a. Species encountered during the expedition. Species shaded in grey are expedition target species.

Common name	Latin name	Common name	Latin name
Birds		**Mammals**	
Northern pintail	*Anas acuta*	Arabian oryx	*Oryx leucoryx*
Grey francolin	*Francolinus pondicerianus*	Arabian hare	*Lepus capensis*
Little grebe	*Tachybaptus ruficollis*	Arabian red fox	*Vulpes vulpes*
Greater flamingo	*Phoenicopterus roseus*	Mountain gazelle	*Gazella gazella cora*
Macqueen's bustard	*Chlamydotis macqueenii*	Sand gazelle	*Gazella subgutturosa marica*
Black-winged stilt	*Himantopus himantopus*	Sand fox	*Vulpes rueppelli*
Spur-winged lapwing	*Vanellus spinosus*		
Red-wattled lapwing	*Vanellus indicus*	**Reptiles**	
Wood Sandpiper	*Tringa glareola*	Spiny-tailed lizard	*Uromastyx leptieni*
Laughing dove	*Spilopelia senegalensis*	White spotted lizard	*Acanthodactylus schmidti*
Pharaoh's eagle owl	*Bubo ascalaphus*	Sandfish	*Scincus scincus*
Indian roller	*Coracias benghalensis*	Desert monitor lizard	*Varanus griseus*
Eurasian hoopoe	*Upupa epops*	Wadi racer	*Coluber rhodorhacis*
Lesser grey shrike	*Lanius minor*		
Brown-necked raven	*Corvus ruficollis*		
Crested lark	*Galerida cristata*		
White-eared bulbul	*Pycnonotus leucotis*		
Arabian babbler	*Turdoides squamiceps*		
Desert whitethroat	*Sylvia minula*		
Black redstart	*Phoenicurus ochruros*		
Desert wheatear	*Oenanthe deserti*		
Purple sunbird	*Cinnyris asiaticus*		
White wagtail	*Motacilla alba*		
Lappet faced vulture	*Torgos tracheliotos*		
Long-legged buzzard	*Buteo rufinus*		
Green bee-eater	*Merops orientalis*		
Chestnut-bellied sandgrouse	*Pterocles exustus*		
Feral pigeon	*Columba livia*		
Rose-ringed parakeet	*Psittacula krameri*		
Southern grey shrike	*Lanius meridionalis*		
Red-vented bulbul	*Pycnonotus cafer*		

Using the IDW method described above, detailed distribution maps of each species were created (see below) to model the distribution of each species and as a baseline to observe how their dispersal changes over the coming years, and what habitats are preferred by which species.

Figure 2.3i. Sand fox caught in a live trap.

Arabian oryx

This year 278 oryx were recorded during the expedition, compared to 98 oryx in 2013, showing that the oryx is widespread throughout the reserve with its highest distribution being just below the central part of the reserve towards the south-western side (Figure 2.3j). The majority of the feeding stations are located in the central area, so this is likely to be the major reason for the hotspot in this area and the large numbers compared to the previous year. In the Northern Zone there is a large area devoid of oryx. This area matches the main area of tour operator tourism activity with tourism camps and the bulk of traffic. The dense network of vehicle tracks in this area is putting pressure on the fragile eco-system, turning the vegetative sand dunes into soft sand dunes, which in turn make oryx movement difficult. This is very likely to be the reason why oryx avoid this area and prefer the South Zone, which is the least disturbed part of the reserve (Figure 2.3j).

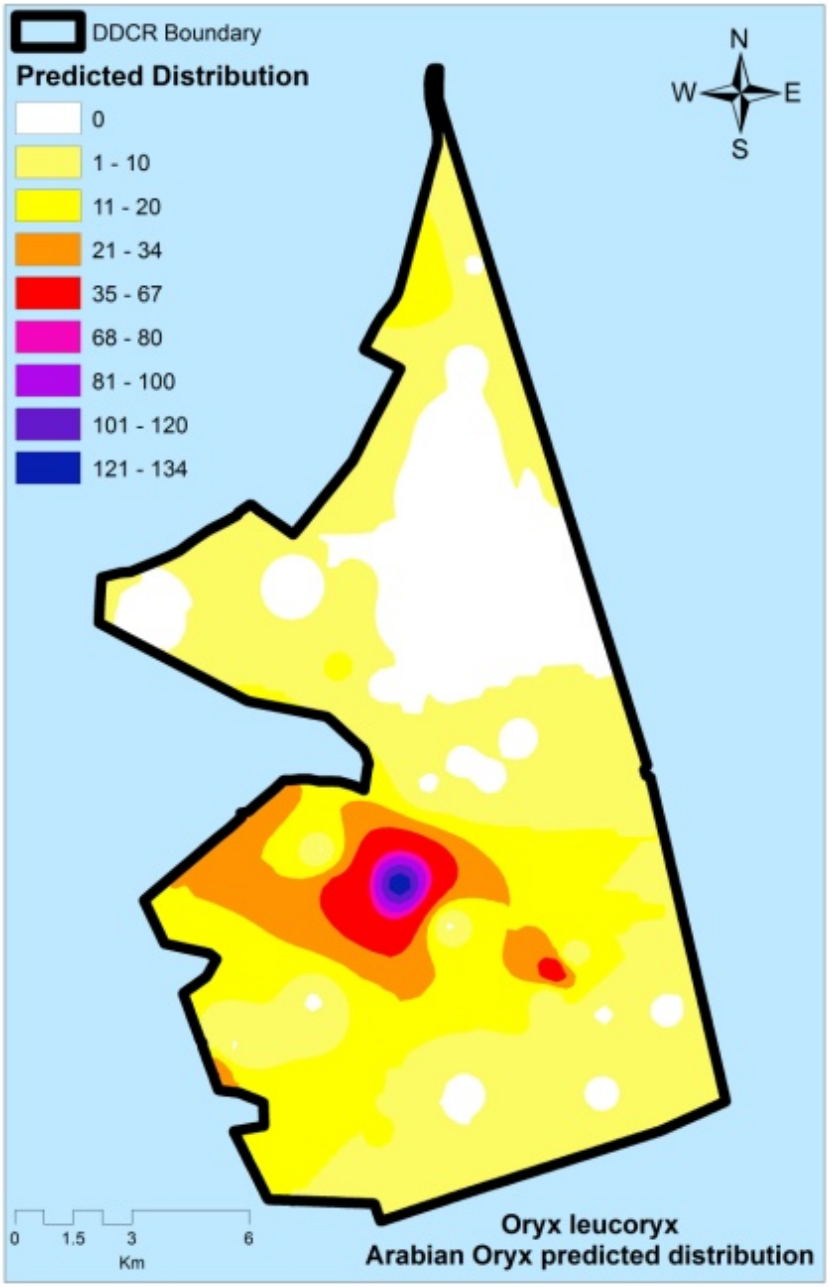

Figure 2.3j. Predicted oryx distribution.

Mountain gazelle

Mountain gazelles are the most abundant of the gazelle species found in the DDCR. 206 were observed during the 2014 expedition compared to 87 from the previous year. The gazelle numbers are alarmingly high and the need for control measures is strong. Mountain gazelles were found on the gravel plains and shifting dunes and are evenly distributed within the reserve. Within this even distribution there are four hotspots: one in the North Zone, two in the Central Zone and one in the Southern Zone.

The nucleus in the North Zone (Figure 2.3k) matches with an old date farm, which is still irrigated with drip irrigation in an attempt to regenerate natural vegetation and attract Macqueen's bustards into the area. In doing so, it also attracts the mountain gazelle, which is feeding off all the new shoots generated by the irrigation.

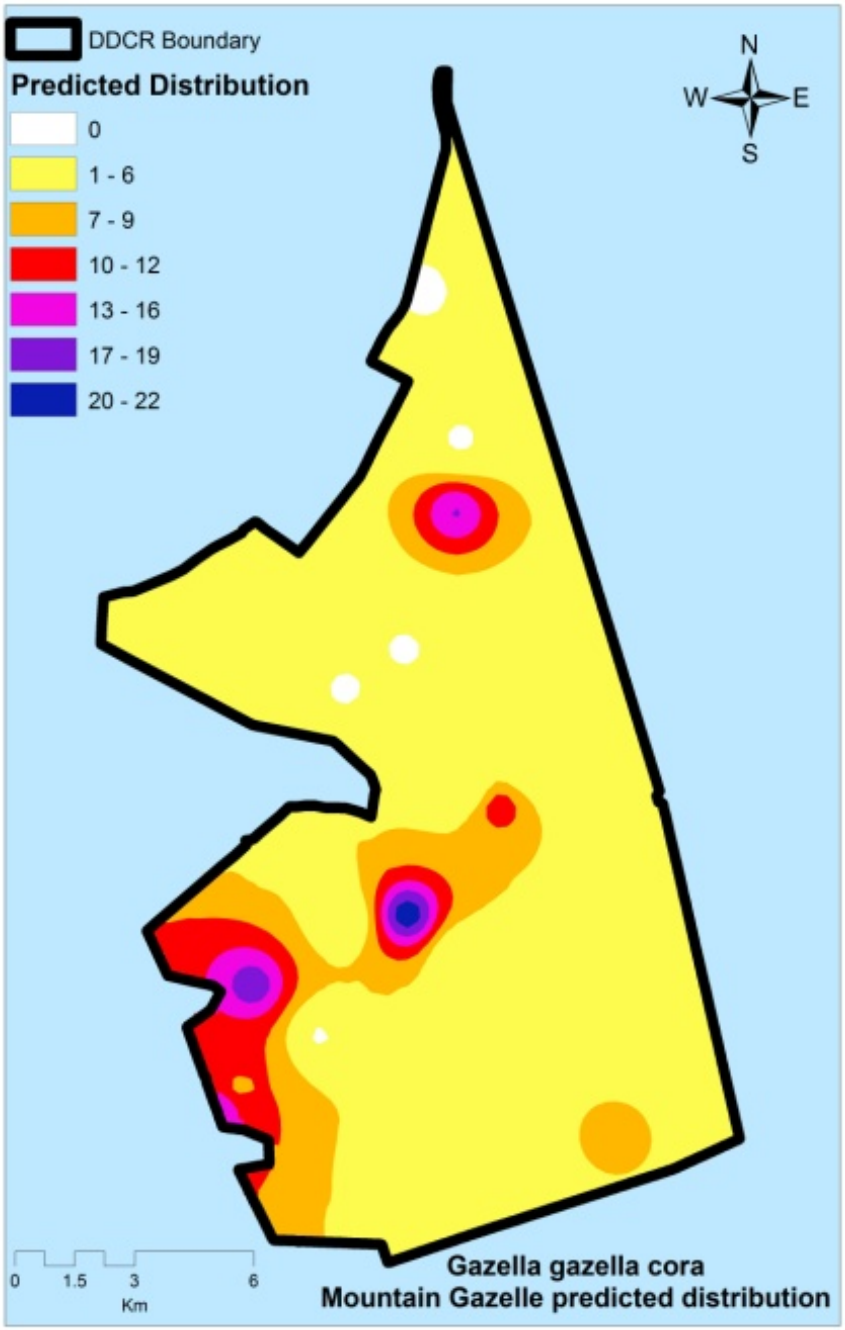

Figure 2.3k. Predicted mountain gazelle distribution.

The Central and South Zone hotspots are the result of the feeding stations, which have been put out for Arabian oryx, but are also attracting mountain gazelle, most likely because there are currently too many animals for the reserve's natural vegetation to support, which has resulted in overgrazing of the area, forcing animals to the feeding stations.

Sand gazelle

The sand gazelle was sighted 159 times in 2014 compared to only 26 times in 2013. This increase in sightings moves them closer in actual numbers to the mountain gazelle. Sand gazelle are evenly distributed throughout the reserve (Figure 2.3l), except for rocky areas, which is outside the sand gazelle's preferred habitat range. The northern corner of the reserve has this habitat. The nucleus in the North Zone is the same date farm that also attracts mountain gazelle (see above). The Central and South Zone hotspots are the result of feeding stations.

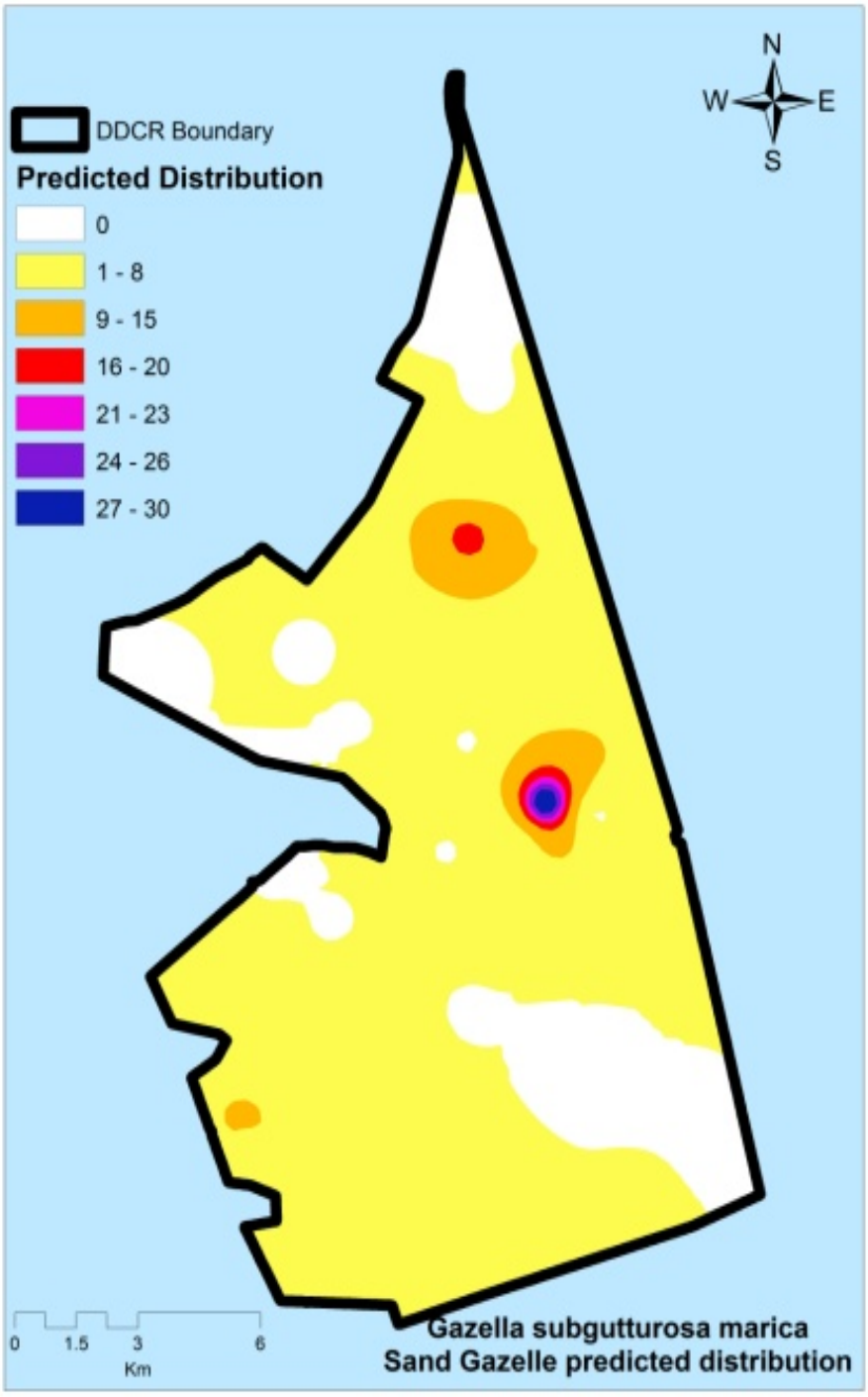

Figure 2.3k. Predicted sand gazelle distribution.

Live trapping

Nine live traps were set: three each in the North, Central and South Zones. Out of the nine traps set, only one trap in the South Zone was triggered with a capture of a sand fox (Figure 2.3l). No Gordon's wildcats or feral cats were caught in the traps. However, cat presence in the form of tracks was recorded at trap 6.

The capture of the sand fox was a highlight as it was the first time that this species has been caught in a live trap in the history of the DDCR.

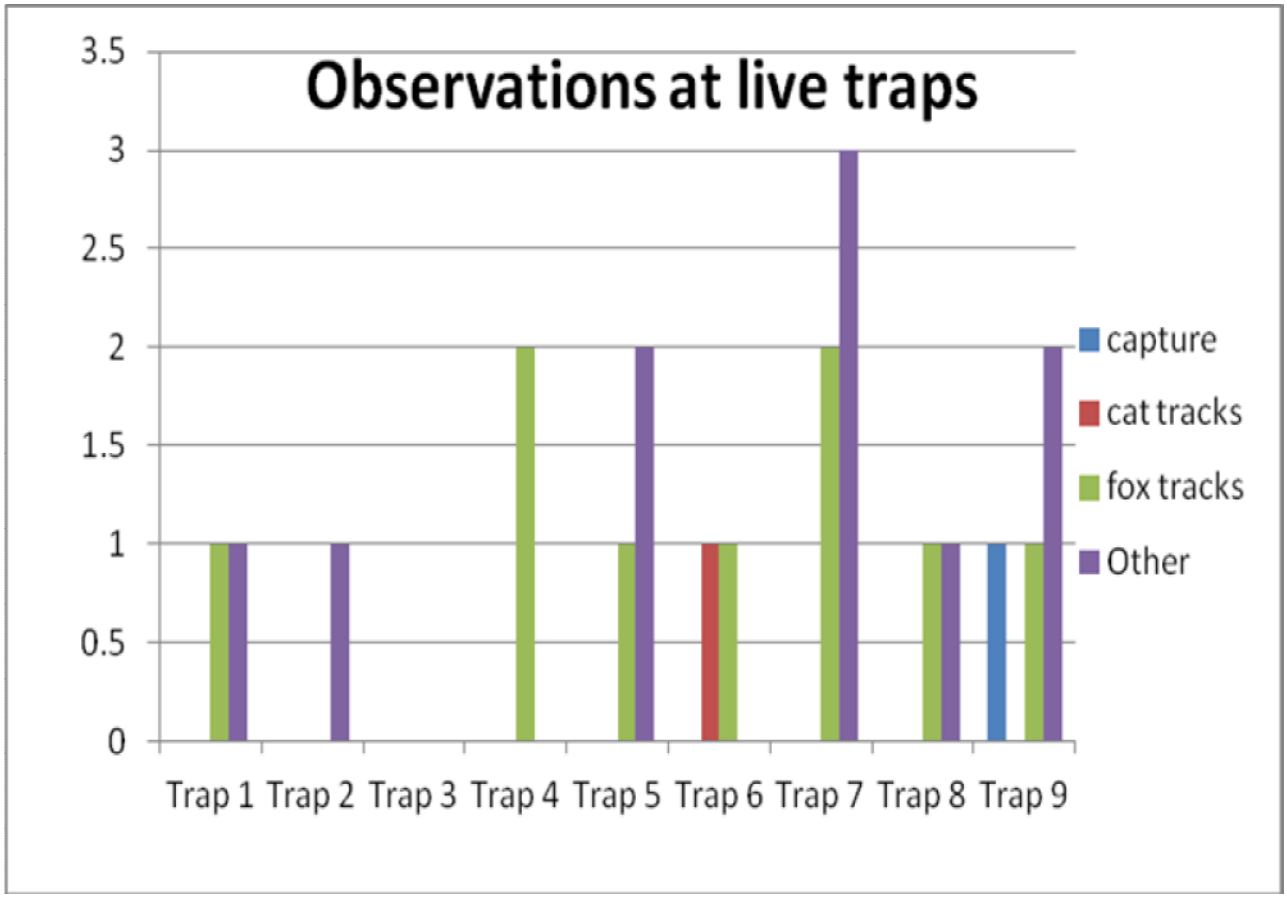

Figure 2.3l. Live trap capture activities.

Camera trapping

During the five nights of camera trapping using seven camera traps, a total of 203 pictures were taken by six camera traps. The main purpose of the camera trapping was to try and capture Gordon's wildcats. This was not successful. Instead red fox, Arabian oryx, brown-necked raven, as well as mountain and sand gazelle were recorded (Figure 2.3m). The big difference this year was that we did not have the same amount of camera traps at our disposal, as all the Cuddeback cameras were unreliable and were not used for this expedition and the new DDCR camera order had not arrived in time for the start of the expedition. Before the expedition began, there was some debate about whether to even include camera trapping as we had so few cameras to work with. In the end we used the six traps we had.

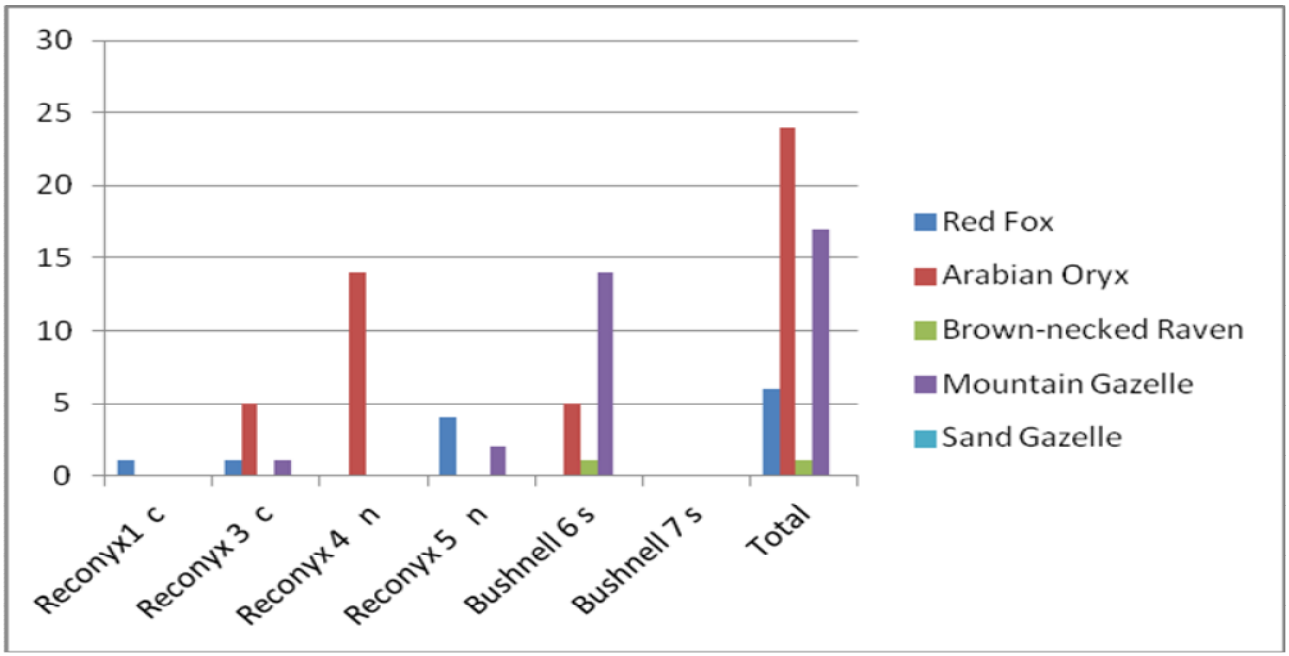

Figure 2.3m. Camera trap capture activities.

Diversity indices

Modelling the diversity distribution of rare species (sand fox, lappet-faced vulture) using the Shannon and Brillouin diversity indices and of abundant species (Arabian oryx) using the Simpson diversity index, shows clearly the predicted diversity of the species within the DDCR (Figure 2.3n).

For example, there are six nuclei modelled on the maps of rare species. These are generated by the sand fox record in the south where its capture develops a high diversity hotspot and by the records of the eagle owl in the west with a clear continuous hotspot. The other records in the centre and the north are for the owls and vultures.

Looking at the abundant species map distribution (Figure 2.3n, right map) it is clear that oryx are all located around the feeding points,

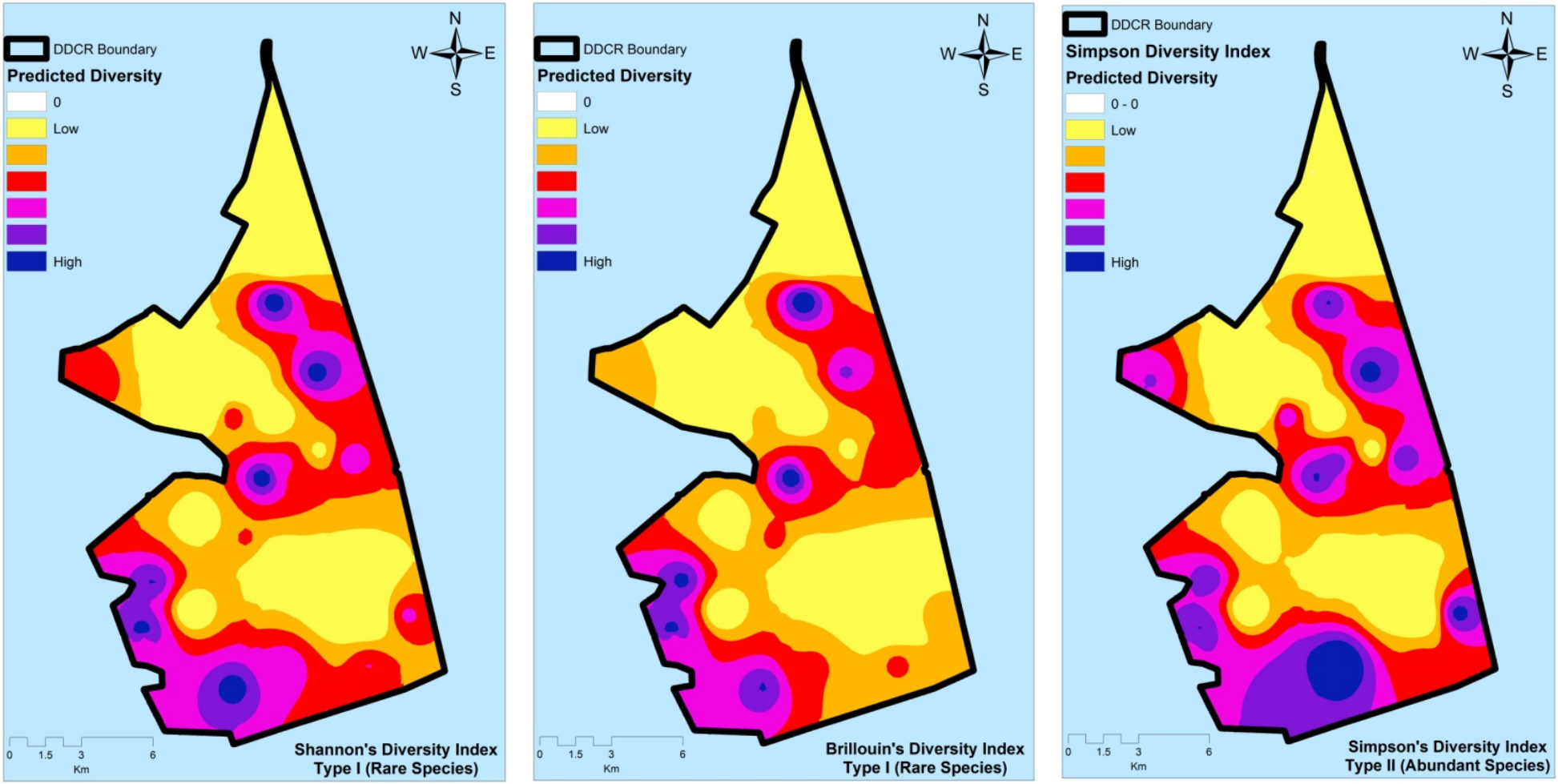

Figure 2.3n. Diversity indices compared.

2.4. Discussion and conclusions

Antelope (oryx and gazelle) herd health and population dynamics

The body condition scoring for the 2014 expedition surveyed a total of 278 Arabian oryx compared to 98 in 2013, resulting in an average score of 2.9 compared to 2.3 last year. This year's result is satisfactory and just below the fit and healthy score of 3.0. The additional feed supplementation will be carefully monitored as oryx body condition scoring can increase very quickly to an overweight score of 4.0 or even more, which would not be beneficial to the oryx population or the reserve.

The oryx body condition scoring shows the importance of volunteer-led survey efforts in for the DDCR's management to be alerted to important issues of wildlife health and, once aware of an issue, also enabling it to make informed management decisions based on the data provided by volunteer efforts.

Another example of citizen science efforts alerting managers to conservation issues is the number of gazelles recorded by the expedition. A total of 206 mountain gazelles and 159 sand gazelles were observed and recorded through species encounters. The majority of these are likely to be separate individuals, as steps were put in place to try and minimise duplication by sending different teams into different quadrants so that most of the area was coved as quickly as possible. With this in mind, the numbers for both species are alarmingly high. It is already evident that under current conditions the reserve cannot sustain the present oryx and gazelle populations without significant supplementary feeding. Furthermore, vegetation surveys have shown that the DDCR vegetation is already showing clear signs of overgrazing (Bell et al. 2013). Therefore a major management concern is the establishment of a gazelle carrying capacity for the DDCR, as well as self-sustaining control measures.

As with most natural systems the solutions are never simple. Increasing the food supply as implemented over the past year following the 2013 expedition survey results has achieved the goal of improving the body condition of the oryx herd, as well as providing some relief to the natural vegetation from grazing pressure. However, an increased level of nutrition will also result in improved breeding success, leading to a further population increase and therefore grazing pressure. Hence, some form of population control is needed. Options currently being explored are the removal of antelopes from the reserve through translocation and the introduction of an apex predator such as the Arabian wolf or hyaena to apply top down pressure to the antelope populations.

Both options have their challenges and may both need to be implemented to achieve the desired result. The introduction of an apex predator would introduce further natural processes with likely positive influences on more than just the reserve's carrying capacity. The impact on the natural system would need to have careful on-going monitoring to assess both the positives as well as any potential negative effects. Furthermore, the social impact of a predator re-introduction on the local human population will need to be managed with due care. Citizen science efforts can play an important role in monitoring effects.

Predator presence and population dynamics

There were no live captures of Gordon's wildcats or feral cats during this expedition. Furthermore no Gordon's wildcats were photographed by camera traps. However, there was a possible presence observed during the expedition in terms of tracks. It is difficult to assess whether the DDCR's Gordon's wildcat population is stable, increasing or declining and more trapping is need to assess this. Major threats to the Gordon's wildcat in the DDCR are likely to be the availability of food, as well as hybridisation with feral cats.

As discussed in last year's expedition report (Bell et al. 2013), due to an extended drought and the effects of overgrazing, the overall vegetation condition is poor. This results in an insufficient seed supply for rodents, thereby reducing their population. High red fox numbers add further pressure to the rodent population. Based on scientific observations and research by the DDCR conservation team for the last 10 years, it is the author's belief that an apex predator could positively affect this process by maintaining a sustainable secondary predator population (see Figure 2.4a). A future rodent trapping survey is required to see the amount of prey species that are available to the wildcats and to see if the local wildcat population might be forced to travel outside of the reserve in search of food.

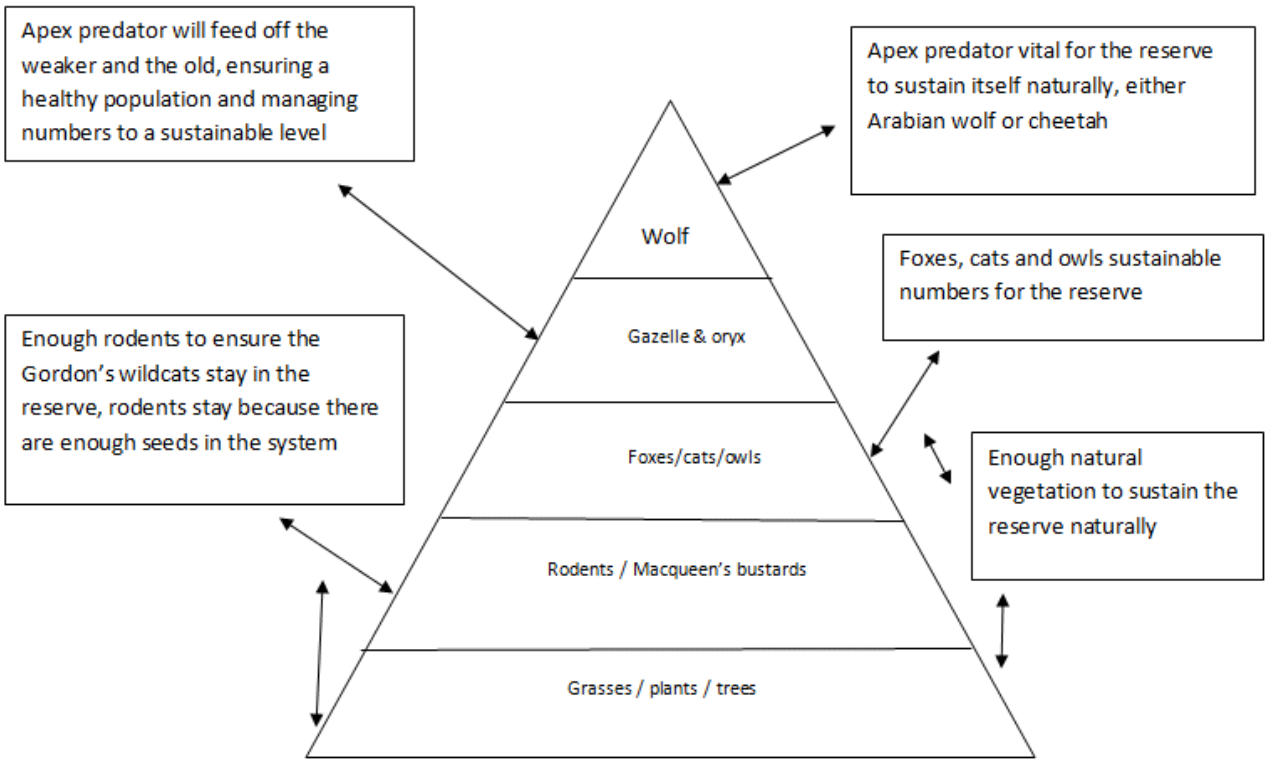

Figure 2.4a. Food web pyramid.

Feral cats within the DDCR impact the wildcat population by filling a niche normally suited to the wildcat, as well as by threatening the genetic integrity of the species through hybridisation. Current trapping on the reserve to counteract this problem is on-going and the benefits of this work will only show in the future. The reserve has just received five cat collars, so a capture, release and monitoring programme will be implemented to obtain vital information on range and habitat utilisation for the species. Citizen science assistance with this project will be a welcome help for local managers.

A rare sand fox was caught by the expedition for the first time in the history of the DDCR, As a result of this capture, further expeditions will start targeting this rare species in an attempt to obtain more information about it.

For rare predators, the Gordon's wildcat as well as the sand fox, rodents are an important food source. Future expedition work should therefore aim to establish, mainly through trapping, the rodent population levels and density within the DDCR. Following the trapping efforts, analyses should be made whether the rodent population is adequate to sustain the population of small predators or whether the wildcats in particular have to travel outside the DDCR in search of food.

IDW and diversity indices modelling

Population modelling using the IDW and diversity indices methods show distributions in accordance with feeding points and habitat preferences. Oryx populations are concentrated around the feeding points, as are gazelles. Mountain gazelle distribution follows their preferred stony/rocky habitat distribution.

The Macqueen's bustard population is small and very confined to specific areas of the DDCR. Over the years a small increase in numbers has been noticed. Currently all bustards on the reserve are introduced and the goal is to see hatchings from these populations to form wild populations.

The lappet-faced vulture is seen fairly regularly as there is a good food source on the DDCR for them. Up until now no nesting pairs have been recorded. The goal is to have these birds nesting on the reserve; to do so, the species requires undisturbed areas with adequate trees for nesting, which the reserve.

Pharaoh eagle owl is a concern and numbers are on the decline, probably due to the scarcity of rain over the past few years, which has affected the vegetation and thereby rodents, which are the owl's primary food source.

Citizen science and reserve management

The ongoing association between the DDCR and Biosphere Expeditions continues to be fruitful. Managers are not only alerted to a variety of conservation issues, but can also make informed decisions based on the data provided by Biosphere Expeditions' citizen scientists. Success stories include the re-establishment of good oryx herd health within 12 months after expedition data first indicated severe undernourishment, or the establishment of high gazelle numbers leading to management plans for the re-introduction of an apex predator being drawn up. This shows the importance of volunteer-led efforts in reserve management and the DDCR would like to thank Biosphere Expeditions and all expedition participants for their enthusiasm and assistance as most of this work would not have been possible without them.

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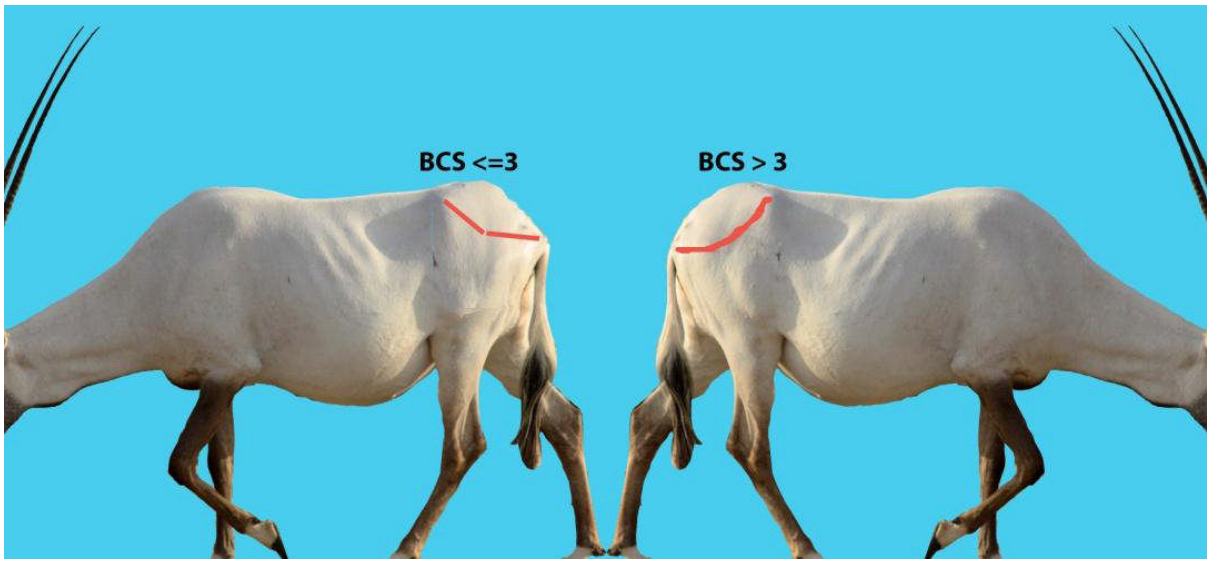
Appendix 1: Oryx body condition scoring

Method

A key using those parts and features is formulated to be used along with photographs to assign values of body condition scores.

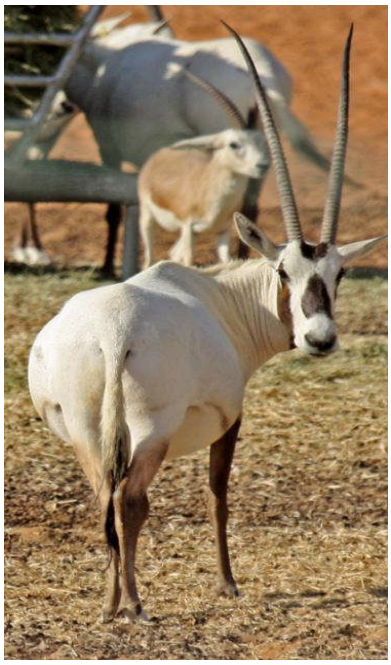
1- Assess thurl line (line between hooks, thurl, pins)

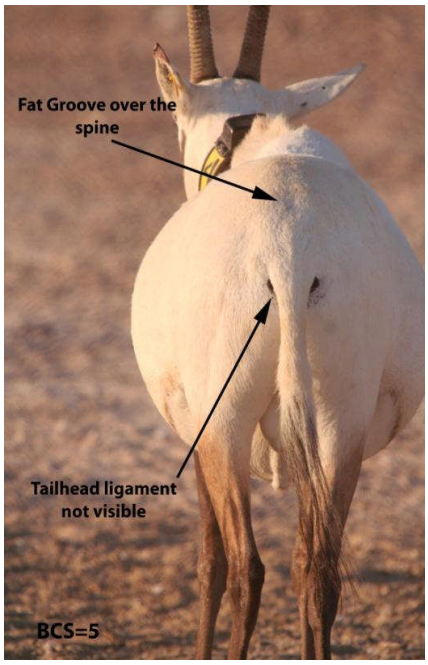
- Thurl line is circular forming a crescent……BCS>3……(2)
- Thurl line is V-shaped ……BCS<=3…… ……(3)



2- Assess thurl line (line between hooks, thurl, pins)

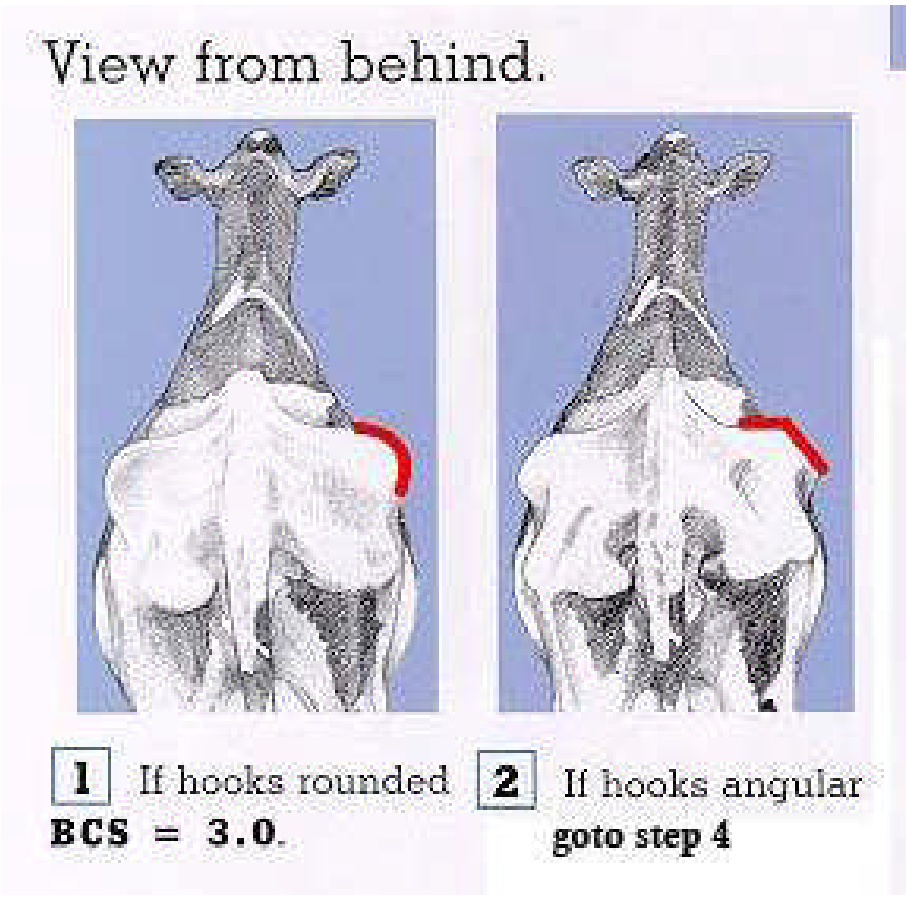
- Spine is fully covered in fat but tail head ligament is visible ……BCS=4
- Spine is covered with fat forming a groove over the spine & tail head ligament is not visible..... ...BCS=5





3- Assess the hooks

- If the hooks are circular in outline……BCS=3
- Hooks are angular in outline …… ……(4)



4- Assess the fat cover over the pins

- If the fat cover is poor and only upper pins are visible or slightly visible……BCS=2
- Fat cover over pins is poor and 2 pairs of pins are visible……(5)

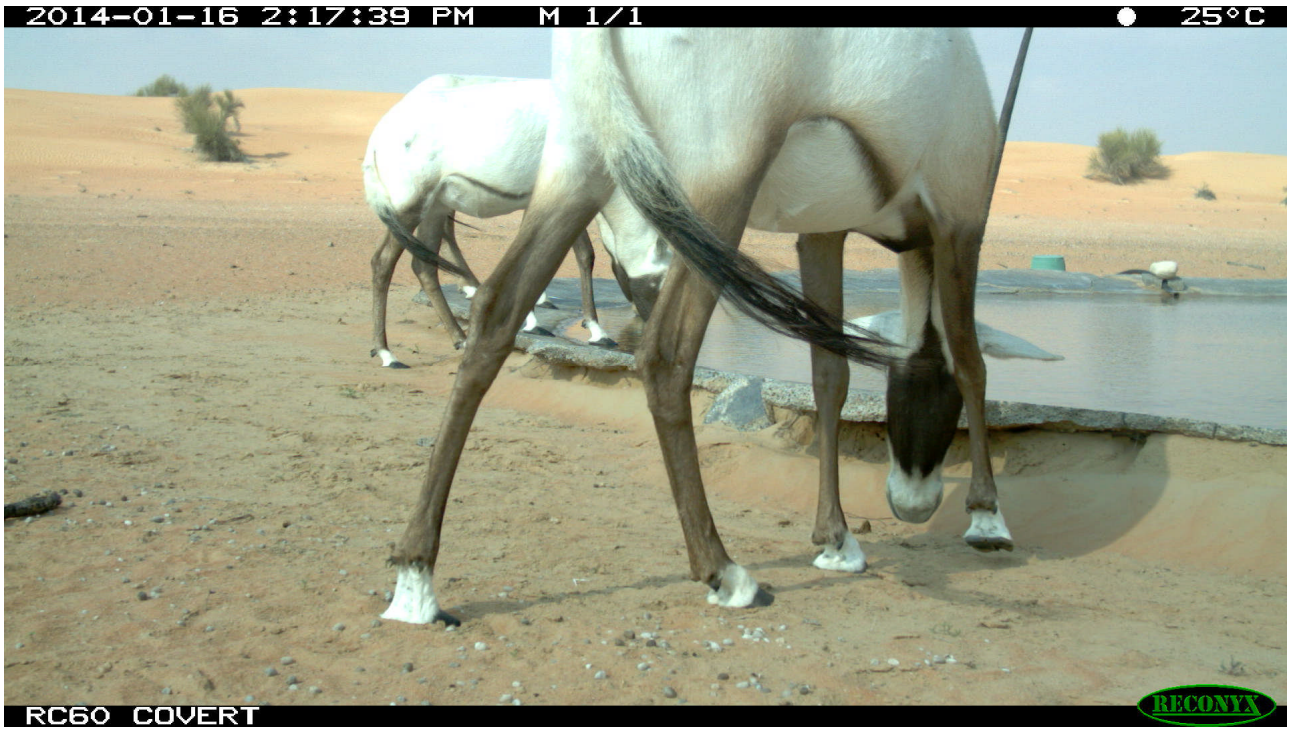
5- Assess the fat cover over the pins

- Spine showing, 2 pairs of pins visible and shallow groove around tail head ligament but caudal vertebrae not visible……BCS=1
- Spine strongly visible, 2 pairs of pins prominently visible, deep grooves a round tail head ligament, and caudal vertebrae are visible……BCS=0

Appendix 2: Camera trap pictures

Arabian red fox

Arabian red fox



Arabian oryx

Arabian oryx drinking

Appendix 3: Expedition diary & reports

A multimedia expedition diary is available on http://biosphereexpeditions.wordpress.com/category/expedition-blogs/arabia-2014/

All expedition reports, including this and previous expedition reports, are available on www.biosphere-expeditions.org/reports.