# EXPEDITION REPORT

**Expedition dates: 20 – 27 January 2018**

**Report published: January 2019**

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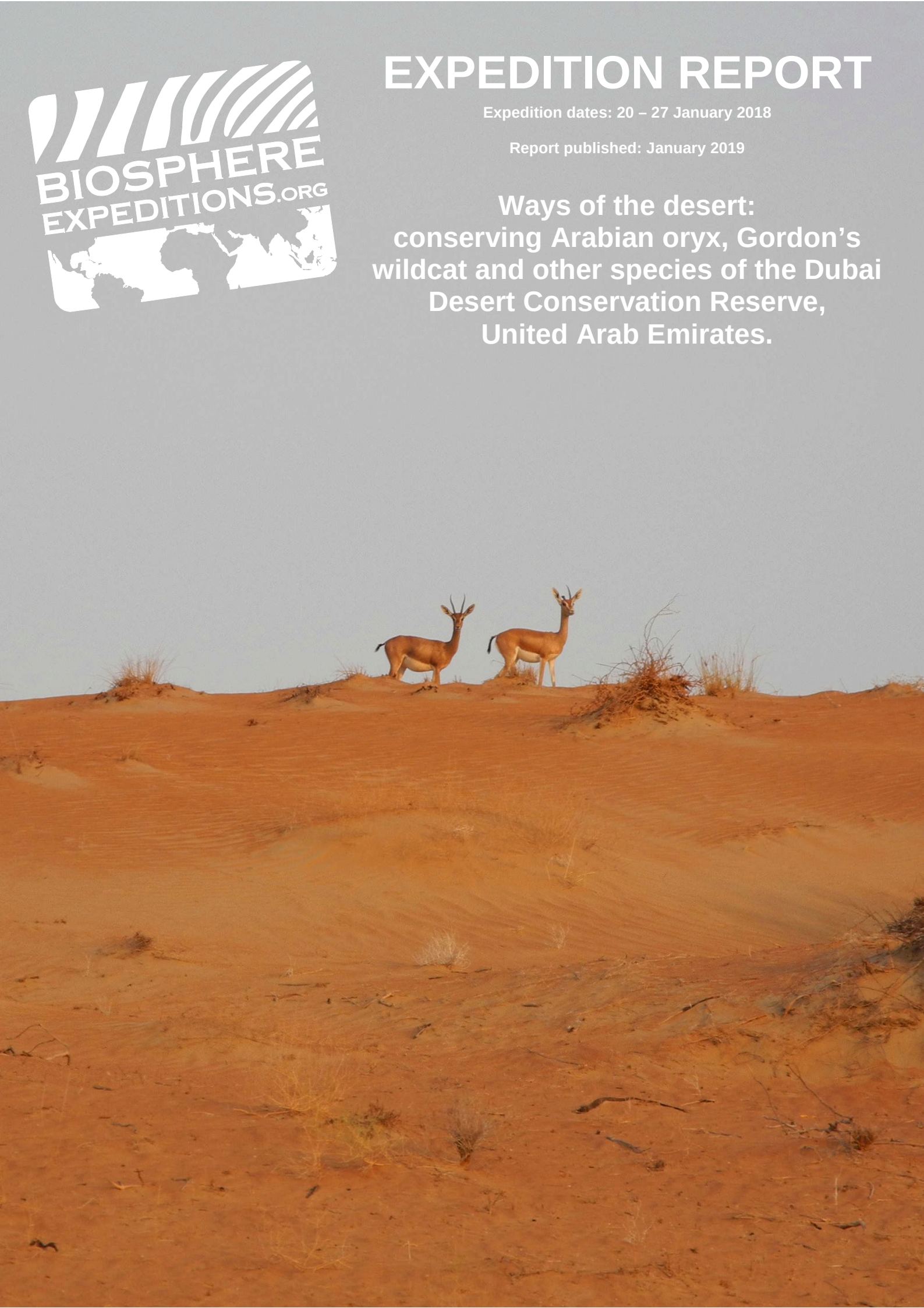

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**Authors:**
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**Dubai Desert Conservation Reserve**

**Matthias Hammer (editor)**
**Biosphere Expeditions**

# Abstract

The successful collaboration between Biosphere Expeditions and the Dubai Desert Conservation Reserve (DDCR), initiated in 2012, continues with citizen scientists collecting data for a week from 20 to 27 January 2018. 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 scientists can aid the efforts of conservation professionals.

Of the target species, the 2018 expedition observed 943 Arabian oryx, 555 mountain gazelle, 171 sand gazelle, 2 red fox, 3 Arabian hare, 18 MacQueen's Bustards, 5 lappet-faced vultures, 1 cinereous vulture and 2 pharaoh eagle owls. 528 individual Arabian oryx were also counted, showing an overall increase of the population.

Both circular and random observations of Arabian gazelle and then combining these for each quadrant greatly improved the predicted distribution of Arabian gazelle when compared to the results from 2017 (Simkins and Hammer 2018). The main concentration of Arabian gazelle is in the central part of the DDCR and appears to be as a result of the adapted habitats such as the irrigated areas at some old farms and tree plantations, which provide more food and shelter for this species.

The counts of sand gazelle have increased from counts in previous years (Simkins and Hammer 2018 and other expedition reports), as well as the regular DDCR counts, and can be considered an accurate estimate of the population within the DDCR. Predicted distribution has expanded from that of 2017; however, the concentrations are consistently in the south of the DDCR and correlate to a concentration of individuals at Tawi Ghadier irrigated area.

A repeat survey on the distribution of vegetation counted nearly 8,500 plants during circular observations. Once again the dominant species was the fire bush (*Leptadenia pyrotechnica*) (8131), followed by congregated ghaf trees (*Procera cineraria*) (264), widely distributed Acacia trees (*Acacia tortilis*) (64) and Sodom's apple (*Calotropis procera*) (31). Predicted distribution of the two shrub species (fire bush and Sodom's apple), which are both important indicator species for the reserve's habitats was not as accurate as in 2017, because the perimeter quadrants were not surveyed due to a smaller expedition team.

The 2018 repeat Arabian red fox den survey shows a 54% reduction in the number of active dens compared to 2017, of which seventeen were abandoned and ten became inactive. However, two inactive and two abandoned dens became active once again. Possible explanations are a reduction in rodent food supply and concomitant expansion of ranges or variability in survey efforts. At this stage it is unclear what the root causes are and as such more intensive training of citizen scientists to ensure consistent survey effort, as well as continued monitoring of red fox dens, will form part of future expeditions. A continued decline in red fox dens could be indicative of a threat to the population within the reserve, which in turn may require a management intervention.

Three live traps were set for five nights for a total of 15 trap nights. The 2018 expedition had more success than the 2017 expedition, when no captures were made. In 2018, tracks of the red fox and cats were observed at all trap locations. There was also one unsuccessful trigger and three captures. The Northern trap was triggered with no capture, but with evidence of fox presence. The Southern trap captured a feral cat on the second night. The Central trap had two captures of a target species, namely the Arabian red fox on the first and last nights.

Of the 17 camera traps set, there were three traps that failed to produce any wildlife photos. However, they were active during the survey period and as such counted towards the camera trapping effort. A total of 85 trapping days captured 4,581 images of which 4,001 were images containing an identifiable subject. 3,084 individual records of naturally occurring fauna were recorded, as well as 1,998 humans or vehicles. Fourteen wildlife species were captured. A high number of bird species (9) were recorded this year. The most significant bird captures were the 134 lappet-faced vultures counted in all the photos from two traps and a rare record in the UAE, only the third ever, of a cinereous vulture. Arabian oryx was the most abundant and widespread species, recorded with 2,194 captures counted in all the photos from ten of the seventeen traps. High numbers of Eurasian collared doves (330) were also captured, nearly all at camera trap 19. Of the target species, 258 Arabian gazelle from nine traps, 18 sand gazelle from three traps, 13 Arabian red fox from three traps, and 5 Arabian hare from one trap were recorded. No Gordon's wildcat or sand fox were recorded by camera traps.

In 2017 the DDCR management received approval to translocate Arabian oryx from the reserve to other protected areas and zoological collections within the region. It was hoped that this would alleviate some of the pressure of a growing population on the environment. However, this has not proved sufficiently successful in 2017 to reduce or even maintain the oryx population size. A project to analyse the genetic composition of the DDCR oryx population will be implemented in 2019 in order to best manage the genetic quality of the herd and place the emphasis on quality, rather than quantity, as a measure of a successful reintroduction programme.

Although currently herd management through the removal of animals from the DDCR is the priority, the reintroduction of an apex predator to restore a natural ecological process putting top-down pressure on he ungulate population will continue to be explored to hopefully find a socially acceptable solution.

# الملخص


مازال التعاون الناجح بين محمية دبي الصحراوية وبرنامج بعثات المحيط الحيوي مستمرا منذ بدء البرنامج في العام 2012م حيث استمرت الدراسة بتجميع البيانات الحقلية بواسطة متطوعين من غير ذوي الاختصاص لمدة أسبوع من 20 يناير 2017م وحتى 27 يناير 2017م. حيث أيدت البيانات التي تم تجميعها للعديد من الملاحظات والأنشطة من قبل إدارة محمية دبي الصحراوية وكذلك ساعدت المحمية في الحصول على العديد من المعلومات المفيدة واتخاذ قرارات صحيحة والتي تصب في صالح المحمية والتي بدورها ساهمت في تعزيز التعاون المثمر بين المتطوعين المهتمين بالحياة البرية والباحثين العاملين بالمحمية.

أجرت بعثة المحيط الحيوي لعام 2018م العديد من المسوحات العلمية للعديد من الأنواع المستهدفة بالدراسة حيث تم تسجيل 943 فرد من المها العربي(*Oryx leuoryx*) ، 555 غزال الأدمي(*Gazella gazella*) ، 171 فرد من غزال الريم (*Gazella marica*)، اثنان من الثعالب الحمراء(*Vulpes Vulpes arabica*) ، ثلاثة أرانب برية(*Lepus capensis*) ، 18 طائر الحباري، ستة من النسور بالإضافة إلى عدد اثنان من البوم الصحراوي(*Bubo ascalaphus*) . ولقد أظهرت الدراسة زيادة بمقدار 528 فرد من المها العربي مقارنة بالعام الماضي مما يدل على الزيادة المستمرة لقطعان المها العربي بالمحمية.

ظهر تحسن كبير في جودة البيانات التي تم تجميعها في تلك السنة حيث تم دمج طريقة تجميع البيانات بصورة عشوائية مع طريقة تجميع البيانات عن طريق النقاط الدائرية وبالمقارنة مع نتائج الدراسة الماضية لسنة 2017م لوحظ أن هناك تركيز رئيسي للغزال العربي في الجزء المركزي للمحمية ويبدو أن ذلك يرجع للتكيف مع البيئات المحيطة من مزارع قديمة والتي يتوفر بها المزيد من الماء والغذاء والمأوي لهذا النوع.

زادت أعداد تسجيل غزال الرمال مقارنة بالتعدادات السابقة ويعتبر التقدير الحالي دقيقاً لتعداد الغزال بالمحمية بمقارنته بالسنين الماضية مع استمرار تركيز التواجد في نفس المناطق التي سجل بها غزال الرمال في السنوات الماضية.

أدي تكرار تجميع بيانات ومشاهدات توزيع النباتات بالمحمية مثال الأشجار والشجيرات الكبيرة الي تسجيل أعداد ما يقرب من 8,500 فرد من النباتات من خلال تسجيل المشاهدات في المواقع التي اعتمدت طريقة النقاط الدائرية. مازال النوع السائد هو شجيرة المرخ (*Leptadenia pyrotechnica*) بأعداد تتراوح إلى (8,131شجيرة)، وأشجار الغاف (*Procera cineria*) (264 شجرة)، وأشجار السمر (*Acacia tortilis*) (64 شجرة)، وشجيرة العشار (*Calotropis procera*) (31 شجرة) لم يكن التوزيع المتوقع لشجيرات المرخ والعشار دقيقا كما كان في العام 2017م حيث كان عدد الفريق صغيرا مقارنة بالعام السابق.

أظهر المسح المتكرر لأوكار الثعالب الحمراء عام 2018م انخفاضا في عدد الاوكار النشطة بنسبة 54% مقارنة بالعام السابق حيث تم التخلي عن 17 وكر وسبعة أوكار أصبحت مهجورة. مع ذلك، تم تسجيل تحول اثنان من الاوكار المهجورة وأثنان من الاوكار الغير نشطة إلى أوكار نشطة ثانية، يمكن ان يكون أحدي التفسيرات المحتملة لتلك الظاهرة هي انخفاض في إمدادات الغذاء من القوارض والثدييات الصغيرة وما يصاحب ذلك من توسع في نطاقات السيطرة للثعالب الحمراء. من غير الواضح في تلك المرحلة ماهي الأسباب الجذرية لتلك الظاهرة ولذلك يجب ان يتبع ذلك التدريب المكثف للمتطوعين والمهتمين لضمان جهد مميز في عمليات تجميع البيانات مع المراقبة المستمرة لأوكار تلك الثعالب مما قد يشكل جزءا من الحملات التطوعية المستقبلية، يمكن أن يكون الانخفاض المستمر في أعداد أوكار الثعالب مؤشرا على إحدى المهددات التي تؤثر على تلك الكائنات بالمحمية مما يتطلب تدخل الإدارة الفوري.

تم نصب ثلاث مصائد لمدة خمس ليال ليصبح المجموع 15مصيدة لكل ليلة، حققت نتائج 2018م نجاحا اكبر من 2017م حيث تم ملاحظة أثار اقدام الثعلب الأحمر والقط البري في جميع مواقع المصائد، تم إغلاق المصائد ثلاث مرات، في شمال المحمية تم إطلاق المصيدة بالرغم من عدم احتجاز أي حيوان بري ولكن وجدت أدلة على وجود الثعلب الأحمر، في جنوب المحمية تم إطلاق المصيدة وبداخلها قط ضال في الليلة الثانية، أما بالنسبة للمصيدة المركزية تم اصطياد الثعلب الأحمر مرتين في الليلة الأولي والليلة الأخيرة.

من بين 17 كاميرا مراقبة للحياة البرية، كان هناك عدد ثلاث كاميرات فشلت في التقاط أي صور للحياة البرية. ومع ذلك، كانت جميع الكاميرات فعالة طوال فترة الدراسة، وبالتالي تم حساب عدد الأيام فيما يتعلق بجهود مصايد الكاميرات. نتج عن ذلك ما مجموعه 85 يوما من المراقبة بالكاميرات حيث تم التقاط حوالي 4,581 صورة منها 4,001 صورة لكائنات حية. وكان عدد 3,084 من تلك المشاهدات للحيوانات الموجودة بالطبيعة وعدد 1,988 صورة لبشر أو مركبات وشملت تلك المشاهدات بكاميرات المراقبة أربعة عشر نوعاً من أنواع الحياة البرية. تم تسجيل عدد تسعة أنواع من الطيور ومنها 134 من النسور العقابية حيث تعتبر من المشاهدات النادرة في الامارات العربية المتحدة. يعتبر المها العربي من أكثر الأنواع وفرة وانتشارا بالمحمية حيث تم تسجيل 2,194 صورة للمها العربي من خلال عشر من مصائد الكاميرات والتي مجموعها سبعة عشر. تم تسجيل عدد 330 من الحمام البري فقط في الكاميرا رقم 19. من الأنواع المستهدفة بالدراسة تم تسجيل عدد 258 غزال عربي في تسع كاميرات و18 غزال رملي من ثلاث كاميرات، 13 ثعلب أحمر من ثلاث كاميرات وكذلك 5 ارانب برية من كاميرا واحدة. لم يتم تسجيل أي قطط او ثعالب الرمال او القطط جوردون البرية بواسطة مصائد الكاميرات.

في عام 2017، تلقت إدارة محمية دبي الصحراوية الموافقة المبدئية على نقل المها العربي من المحمية إلى مناطق محمية أخرى داخل منطقة غرب أسيا وشمال افريقيا. كان من المأمول أن يخفف هذا من بعض الضغوط الناتجة عن الزيادة في أعداد المها العربي. تقوم محمية دبي الصحراوية حاليا بتنفيذ مشروع بحثي لتحليل التكوين الوراثي لقطعان المها العربي بشكل أفضل.

بالرغم من أن هدف محمية دبي الصحراوية الأساسي من إدارة قطعان المها والغزلان هو تقليل الاعداد ويعتبر من الأولويات الضرورية فإن محاولات إعادة إدخال مفترس رئيسي لاستعادة التوازن البيئي الطبيعي مستمرة علي أمل الوصول لحل مقبول اجتماعيا

# Contents

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# 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 20 – 27 January 2018 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 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 and mountain 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 for the formation of a formal national park. The proposal was accepted and sanctioned almost immediately, and work began on protecting the area that would be known as the DDCR.


**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 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 (27 km²) was the core area for the reintroduction of the Arabian oryx, mountain gazelle and sand gazelle. Currently the DDCR contains approximately 450 Arabian oryx from the 100 that were originally reintroduced in 1999. Both the Arabian oryx and the gazelle species have expanded within the DDCR naturally as the amount of human activity has decreased and been controlled. Mountain and sand gazelle can now be seen throughout the DDCR.

## 1.3. Dates

The expedition ran from 20 - 27 January 2018 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 (a Bedu mess tent, a 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. All meals were provided by a catering company.

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 overcast most mornings, clearing up to the usual cloudless sky later in the day.

Field communications

There was an (emergency) telephone close to base and mobile phones 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 an expedition diary on Biosphere Expeditions' social media sites.

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 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 or other incidences during the expedition and none of the medical support network or safety procedures were called upon.

### 1.5. Scientist

Greg Simkins is South African by birth 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 area that later became 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, 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 & Communications and worked for more than a decade in the creative department, but also in PR & marketing of a publishing company. Her love of nature, travelling and the outdoors (and taking part in a couple of Biosphere expeditions) showed her that a change of direction was in order. Joining Biosphere Expeditions in 2008, she runs the German-speaking operations and the German office, and leads expeditions all over the world whenever she can. She has travelled extensively, is multilingual, a qualified off-road driver, diver, outdoor first aider, and a keen sportswoman.

### 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): Rick Allain (UK), Catherine Capon (UK, blogger for part of the expedition), Dirk Lansch (Germany), Anjum Misbahuddin (UK), Mary Spratt (UK), Andrew Trace (UK, cameraman), Toby Whaley (Germany). Also assistant expedition leader Paul Franklin (UK).

### 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.

### 1.9. 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, and the Friends of Biosphere Expeditions for their sponsorship and/or in-kind support. Finally thank you to Andy Trace for making a great video of his experience.

### 1.10. 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 www.biosphere-expeditions.org/reports. Enquires should be addressed to Biosphere Expeditions via www.biosphere-expeditions.org/offices.

## 1.11. Expedition Budget

Each team member paid towards expedition costs a contribution of €1,870 for the seven-day expedition. The contribution covered accommodation and meals, supervision and induction, all maps and special non-personal equipment, and 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 visas 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 | 9,063 |
| | |
| **Expenditure** | |
| Staff<br>includes local & international salaries, travel and expenses | 2,734 |
| Research<br>includes equipment and other research expenses | 432 |
| Transport<br>includes car hire, fuel, taxis and other local transport | 1,692 |
| Base<br>includes food and camping fees | 997 |
| Miscellaneous<br>includes local sundries and fees | 40 |
| Team recruitment Arabia<br>as estimated % of PR costs for Biosphere Expeditions | 8,676 |
| | |
| **Income – Expenditure** | **- 5,508** |
| | |
| **Total percentage spent directly on project** | **161%*** |

*This means that in 2018, the expedition ran at a loss and was supported over and above the income from the expedition contributions and grants by Biosphere Expeditions.

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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.

### Previous work 2012 – 2017

Biosphere Expeditions and the DDCR first considered working together in 2011 and the first joint expedition was run in 2012 in what has become an annual survey expedition each January.

The aim in **2012** (Bell et al. 2013a) was to conduct the first systematic survey of Arabian oryx (*Oryx leucoryx*) and Gordon's wildcat (*Felis silvestris gordoni*) in the DDCR. This was achieved through three main survey activities: Gordon's wildcat live capture survey and camera trapping as well as Arabian oryx monitoring. In addition, the expedition team recorded any other species observation or encounters while in the field.

The live capture survey of 48 trap nights resulted in one capture of a feral hybrid cat. The camera traps recorded 316 pictures over 56 camera days at a capture rate of 2.46 per day. Fourteen oryx herds were surveyed, which gave a male:female sex ratio of 2:3 and an average condition score of 2.81. In conjunction with the camera trap and Arabian oryx monitoring data, the species encounters data provided a snapshot of species distribution and diversity, which served as a comparative baseline for future expeditions data.

In **2013** (Bell et al. 2013b), species studied included the Arabian oryx (classified by IUCN as vulnerable), other antelope species (sand and mountain gazelle, *Gazella marica* and *Gazella gazella*), Gordon's wildcat as well as some major bird and reptile species. A grid methodology was adopted and forty-two grids 2 x 2 km in size were surveyed within the 225 $km^2$ area of the DDCR. Sample methods included encounter surveys, camera and live trapping and body scoring (for oryx). It was found that mountain gazelle (87 encounters), sand gazelle (26 encounters), Arabian red fox (*Vulpes vulpes arabica)* (24 camera trap pictures) and Arabian oryx were common throughout most of the study area. Gordon's wildcat was not documented by camera or live traps, but only by tracks, which can be misidentified. Because of this result, the DDCR made plans to enhance the population through the reintroduction of genetically pure, captive bred, Gordon's wildcat.

The body condition scoring for oryx revealed malnutrition, and supplementary feeding was increased by DDCR management. The expedition found that the oryx distribution had largely shifted to the north of the reserve as a result of a sustained drought, but a few hardy and now largely independent herds persisted in the south. Sand gazelle populations shifted northwards within the reserve as a result of expanding populations needing to establish new, if less favourable territories. Nine lappet-faced vultures (*Torgos tracheliotos*), rare in the UAE were recorded, showing that the DDCR is likely to be the best habitat for this species in the UAE.

In **2014** (Bell & Hammer 2014), citizen scientists collected data on nine target species, namely the Arabian oryx, Gordon's wildcat, mountain gazelle, sand gazelle, Arabian red fox, sand fox (*Vulpes rueppellii*), MacQueen's bustard (*Chlamydotis macqueenii*), lappet-faced vulture and pharaoh eagle owl (*Bubo ascalaphus*). 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.

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. After the feed increase based on the 2013 expedition results, this was a highly satisfactory management result.

A total of 206 mountain gazelles and 159 sand gazelles were counted during the expedition. Since the majority of these were likely to have been separate individuals, the numbers found for both species were considered to be alarmingly high. It was evident that under current conditions the reserve could not sustain the present oryx and gazelle populations without significant supplementary feeding. Furthermore, previous vegetation surveys showed that the DDCR vegetation was already showing clear signs of overgrazing. Therefore, the expedition concluded that a major management requirement was the establishment of a gazelle-carrying capacity for the DDCR, as well as self-sustaining control measures. Such control measures may 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. The expedition concluded that 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 were 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, it was concluded that further expeditions should 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 showed distributions in accordance with feed points and habitat preferences.

Oryx populations were found to be concentrated around the feed points, as were gazelles. Mountain gazelle distribution was found to follow their preferred stony/rocky habitat distribution.

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

In **2015** (Bell & Hammer 2015), citizen scientists continued to collected data on the nine target species of 2014 (see above).

258 oryx were counted in the reserve, most of them likely to be separate individuals. Oryx distribution in the reserve followed artificial feeding points. However, there were found to be too many oryx in the reserve and it was recommended that their numbers be reduced, amongst other things, in order to discontinue artificial feeding, which is not in line with the DDCR's goal of non-interference in the reserve. The expedition report argued that this reduction in numbers could be achieved through natural processes by introducing a top predator (most likely the Arabian wolf) into the reserve as soon as fence upgrades were completed.

At 218 individuals counted, the mountain gazelle was at healthy population levels. Its distribution followed habitat preference of vegetated dunes and areas of high vegetation and water around the Al Maha resort.

The sand gazelle population was found to have grown, successfully expanding in the reserve and showing new distribution hotspots that mirrored its preferred vegetated sand dune habitats. Only 37 gazelles were counted by the expedition, but this was a reflection of expedition participants being busy with many other tasks.

Gordon's wildcats and sand foxes continued to be rare and elusive, with no live or camera captures in 2015. This is in contrast to the Arabian red fox, which was abundant, dominating camera captures alongside oryx.

Pharaoh eagle owls were found again to be in decline, probably due to low rodent prey availability because of a prolonged drought, and due to the abundance of red fox, which prey on the owl's ground nests. This was found to be a concern, which needs to be addressed by management.

The MacQueen's bustard population was found to be small again with low nesting incidences and success, despite favourable conditions. The reasons for this may be another area for future expeditions to investigate.

The lappet-faced vulture was found to have gone from rare to abundant and the DDCR is now the best place in Dubai to observe vultures. However, no nesting was observed, despite favourable conditions. This conundrum was suggested to be another area for future expedition investigation.

A limited pilot rodent trapping effort in one habitat, yielding 13 individuals of one species (Cheesman's gerbil *Gerbillus cheesmani*), suggested that the rodent population had not suffered greatly from the drought conditions and abundance of red foxes. This finding was in contrast to the pharaoh eagle owl decline, which suggested a decline in the rodent population. It was argued that rodent trapping efforts should be expanded during future expeditions to capture more species in a larger variety of habitats in order to corroborate or disprove the owl decline hypothesis.

In **2016** (Simkins et al. 2016), the expedition observed 498 Arabian oryx, 181 mountain gazelle, 71 sand gazelle, 38 lappet-faced vultures, 8 MacQueen's bustards, 2 red fox, 1 Arabian hare (*Lepus capensis*) and 1 pharaoh eagle owl. An improved survey methodology of circular observations within each quadrant significantly improved data quality, thereby improving predicted species distributions.

Live trapping was carried out for small- (rodents) and medium- (wildcat and fox) sized mammals over a trapping effort of 72 and 83 trapping nights, respectively. Trapping success was very low, with only three Cheesman's gerbils captured.

The red fox den survey revisited 161 den sites and identified seven new dens. In the five-year period between surveys, the number of active dens has not decreased significantly, although only 34% of den statuses remained the same as in 2011. Twenty-five inactive dens became active and 24 active dens became inactive. Only 18% of active dens were abandoned, whereas 47% of inactive dens were abandoned.

Camera traps (unbaited in 2016) captured 12 Arabian oryx, 4 Arabian Gazelle and 1 Arabian hare.

The expedition survey results since 2012 showed an increase in all the reserve's ungulate species and the management of the DDCR is well aware that in order to achieve the stated aim of herd self-sustainability, the size of the ungulate populations will have to match the carrying capacity for ungulates of the DDCR as provided by the natural vegetation. A long-term study to determine the carrying capacity of the reserve is ongoing. In 2016, DDCR management suspected that the population levels exceeded carrying capacity, especially during extended dry periods. Control measures that were considered consisted of a combination of an apex predator reintroduction, and species relocation and utilisation.

In **2017** Simkins & Hammer (2018) observed the following target species during a quadrant survey: 345 Arabian oryx, 360 mountain gazelle, 69 sand gazelle, 2 Arabian red fox, 5 Arabian hare and 3 pharaoh eagle owl. In 2017 for the first time the expedition collected data on the distribution of vegetation, in particular large shrubs and trees. Nearly 10,000 plants were counted during the circular observations. The dominant species were fire bush (8,888), the congregated ghaf trees (823), date palms (140) and the more widely distributed Sodom's apple (112). Predicted distribution of the two shrub species have provided the DDCR management with the most accurate picture to date of the distribution of these two indicator species within the reserve's habitat.

The 2017 survey of red fox dens showed a 59% reduction in the number of active dens, most of which were abandoned, and a 25% reduction in inactive dens, of which only two dens became active.

There were, however, 44 new den sites (14 active, 21 inactive and nine abandoned) discovered in 2017 compared to only seven new sites found in 2016. Continued monitoring of all den locations is recommended on future expeditions. The Arabian red fox will need to be closely monitored due to the sudden reduction in active dens.

Of the 18 camera traps set, there were two traps that failed to produce any meaningful photographs. A total of 76 trapping days captured 4,064 images, of which 3,312 were live images; 2,363 of these contained naturally occurring fauna and 713 contained humans or vehicles. This included seven photos of the nocturnal Arabian hare and over 270 records of the Arabian red fox. However, the rare and cryptic species within the DDCR, namely Gordon's wildcat and sand fox, were once again not recorded.

**Background on species under investigation**

Simkins & Hammer (2018) and expedition reports prior to this have detailed descriptions of the background of species under investigation, which are the Arabian oryx (*Oryx leucoryx*), Gordon's wildcat (*Felis silvestris gordoni*), Arabian or mountain gazelle (*Gazella gazella*), sand gazelle (*Gazella marica*), 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*).

## 2.2. Methods

Expedition participants assisted DDCR scientists in four important surveys: live trapping (targeting Gordon's wildcat and both fox species), the fox den survey, camera trapping and ungulate monitoring (Arabian oryx, Arabian gazelle, sand gazelle). In addition to these surveys, participants were tasked to record any species observed while in the field.

After a training period that lasted one and a half days, participants were split into four groups to conduct the various surveys, in four separate zones of the DDCR, namely a North Zone, Central Zone, South Zone and Perimeter Zone (see Figure 2.2a). Each zone comprised fifteen 2 x 2 km quadrants, the perimeter zone comprised of 17 partial quadrants. These 62 quadrants together represented approximately 214 km² of the 225 km² of the DDCR (or 95%). The area included all key habitats of vegetated dunes, sand dunes and gravel plains.

Every day each group of expedition participants was tasked to survey four quadrants or approximately 16 km². A total of 62 quadrants (214 km²) were surveyed in this way during the expedition. During surveys any target species encounters were recorded in the relevant datasheets.

Target species quadrant survey

This involved the selection of one observation point within 300 m of the centre of the quadrant, which provided a good vantage point. From this vantage point a 360º circular observation of the surrounding area was carried out by four participants with binoculars for 30 minutes.

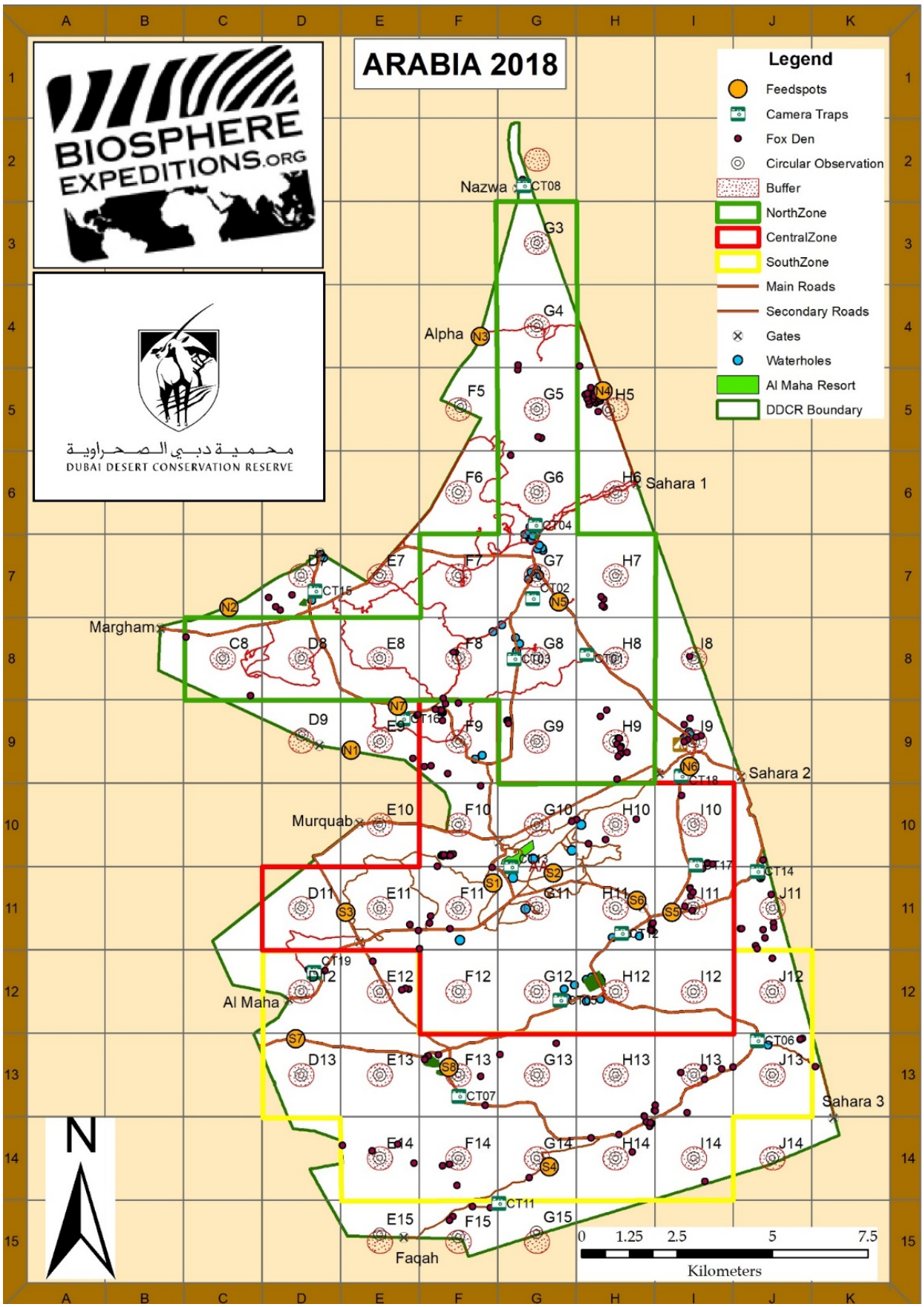


**Figure 2.2a.** The DDCR and its survey zones (North = green, Central = red, South = yellow). The perimeter zone comprises all other zones within the DDCR.

Target species as described above and encountered during these surveys were recorded in the datasheets as follows: species name, 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., and additional comments. In addition, for the first time on this project, trees and large shrubs were counted as well.

During analysis, IDW (Inverse Distance Weighted Interpolation) was used to predict the value (abundance and distribution of species sampled at each cell = quadrant) of cells at locations that lack sampled points (ESRI 2012). Inverse distance weighted methods determine cell values using a linear-weighted combination set of sampling points and are 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. 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 for medium-sized animals

Three 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 a live trap to place within their allocated zones (North, South, Central zones). Each group marked the position of the live trap in the GPS. The live traps were baited with tinned sardines and left out in the field for five nights, resulting in a total of 15 trap nights. The bait was placed right at the back of the trap (using an extendable reacher/grabber), forcing the animal to step onto a pressure plate to trigger the trap. The pressure plate was covered with sand to give the trap a more natural feel and to ensure that the target species was at ease when entering the trap.

Each morning groups set out into their zones to check each of their live traps. This involved checking the surroundings of the traps for a possible presence/absence record from tracks around the trap, to see if the trap had been disturbed or investigated by a Gordon's wildcat or a feral cat. Where necessary, traps were rebaited.

Arabian red fox den survey

The Arabian red fox is the largest predator within the DDCR, so it is important to monitor its population. The red fox is both a nocturnal and cryptic species, so direct counts are unreliable. A better method of monitoring the population is through a count of their dens. This was initially done by DDCR staff in 2011 and then repeated in 2016 with the help of Biosphere Expeditions, when all dens were classified as either active, inactive or abandoned based on signs of fox activity such as tracks, fresh digging, prey remains and fresh scat.

During the 2018 expedition all dens sites were revisited and once again classified based on signs of fox activity, with an additional classification of abandoned when the den had filled in with sand. In addition, any new dens found were recorded and classified. The density estimates of red fox dens in the DDCR were then calculated using ArcGIS software tools based on Kernel density estimates

Camera trapping

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 an infrared and/or motion detector. This has the advantage of detecting with equal efficiency both nocturnal and diurnal activities with minimal environmental disturbance.

Seventeen camera traps (three Reconyx RC60, five Reconyx Hyperfire and nine Bushnell Trophy Cam HD) were used during the expedition and distributed across the four zones Predetermined quadrants in each of the zones were chosen for the survey groups to set their camera traps in, close to water sources. Once again, the traps were not baited (as this tended to attract red foxes, probably keeping Gordon's wildcats away as a result) and left out in the field for five days, resulting in potentially 85 trap nights.

## 2.3. Results

Species encounters

**Table 2.3a** Species encountered during the expedition. Encounter method S = sighting, L = live trap, C= camera trap.

| **Common name** | ***Latin name*** |
|---|---|
| **Birds** | |
| Grey francolin S | *Francolinus pondicenanus* |
| Egyptian goose S | *Alopochen aegyptiaca* |
| Gadwall S | *Ana strepera* |
| Garganey S | *Anas querquedula* |
| Great cormorant S | *Phalacrocorax carbo* |
| Cinverous vulture C | *Aegypius monachus* |
| Lappet-faced vulture | *Torgos trachieliotos* |
| Pallid harrier S | *Circus macrourus* |
| Long-legged buzzard S C | *Buteo rufinus* |
| Greater spotted eagle S | *Aquila danga* |
| Lesser kestrel S | *Falco naumanni* |
| Common kestrel S | *Falco tinnunculus* |
| MacQueen's bustard S | *Chlamydotis macqueenii* |
| Red-wattled lapwing S C | *Vanellus indicus* |
| Common moorhen S | *Gallinula chloropus* |
| Black-winged stilt S C | *Himantopus himantopus* |
| Green sandpiper S | *Tringa ochropus* |
| Terek sandpiper S | *Xenus cinereus* |
| Chestnut-bellied sandgrouse S | *Pterocles exustus* |
| Feral pigeon S | *Columba livia* |
| Eurasian collared dove S C | *Streptopelia decaocto* |
| Laughing dove S C | *Spilopelia senegalensis* |
| Pharaoh eagle owl S | *Bubo ascalaphus* |
| Eurasian hoopoe S | *Upupa epops* |
| Southern grey shrike S | *Lanius meridionalis* |
| Arabian babbler S | *Turdoides squamiceps* |

**Table 2.3a (continued)** Species encountered during the expedition. Encounter method S = sighting, L = live trap, C= camera trap.

| Common name | *Latin name* |
|---|---|
| Brown-necked raven S C | *Corvus ruficollis* |
| Crested lark S C | *Galerida cristata* |
| White-eared bulbul S | *Pycnonotus leucotis* |
| Greater hoopoe lark S | *Alaemon alaudipes* |
| Black-crowned sparrow-lark S | *Eremopterix nigriceps* |
| Asian desert warbler S | *Sylvia nana* |
| Desert wheatear S | *Oenanthe deserti* |
| House sparrow S | *Passer domesticus* |
| Purple sunbird S | *Nectarinia asiatica* |
| | |
| **Arthropods** | |
| Arabian death stalker S | *Apishobuthus pterygocercus* |
| Desert runner (ant) S | *Cataglyphis niger* |
| | |
| **Mammals** | |
| Arabian oryx S C | *Oryx leucoryx* |
| Arabian hare S C | *Lepus capensis* |
| Arabian red fox S C | *Vulpes vulpes arabica* |
| Arabian gazelle S C | *Gazella gazella* |
| Sand gazelle S C | *Gazella marica* |
| Arabian jird S | *Meriones arimalius* |
| Feral cat L | *Felis catus* |
| Cheesmans gerbil S | *Gerbillus cheesmani* |
| | |
| **Reptiles** | |
| Arabian toad-headed agama S | *Phrynocephalus arabicus* |
| White spotted lizard S | *Acanthodactylus schmidti* |
| Sandfish S | *Scincus scincus* |
| Baluch rock gecko S | *Bunopus tuberculatus* |
| Schokari sand racer S | *Psammophis schokari* |
| Hooded malpolon S | *Malpolon moilensis* |
| Jayakar's sand boa S | *Eryx jayakari* |

Of the target species, the 2018 expedition observed 943 Arabian oryx, 555 mountain gazelle, 171 sand gazelle, 2 red fox, 3 Arabian hare, 18 MacQueen's bustards, 5 lappet-faced vultures and 2 pharaoh eagle owls.

Ungulate survey

Over the years, the ungulate counts conducted by Biosphere Expeditions have shown an inconsistency when compared to the established methodology of weekly counts by DDCR staff, which focus mainly on wildlife support infrastructure such as feed spots, waterholes and irrigated areas. This may be a result of the differing emphases year to year of the expeditions, which can result in skewed data (see Figure 2.3a). For example, when the expedition task was primarily body condition scoring, citizen scientists spent a lot of time with the oryx herds resulting in a much higher count than simple observations.

Arabian oryx

In 2018, an emphasis on collecting good data from all the circular observations combined with focused counts at all the feed spots ensured that an accurate count of the population (528) was achieved, especially when compared to the 2017 Biosphere Expeditions count that did not take into account the oryx at all the feeding spots (Simkins and Hammer 2018). The 2016 expedition had more emphasis on aspects of the oryx herd such as body condition scoring to estimate herd health. This also resulted in an accurate population estimate, but - as expected - the 2018 population estimate also shows an increase of the population due to the natural growth of the oryx herd. The predicted distribution of Arabian oryx across the DDCR has greatly improved from 2017 with more areas with a high concentration of animals reflecting the true distribution of the reserve's oryx herd (Figure 2.3b).

Arabian gazelle

During the 2018 expedition, collecting quality data from both circular and random observations and then combining these for each quadrant greatly improved the predicted distribution (Figure 2.3c) of Arabian gazelle when compared to the results from 2017 (Simkins and Hammer 2018). The main concentration of Arabian gazelle is in the central part of the DDCR and appears to be as a result of the adapted habitats such as the irrigated areas at the old farms and tree plantations, which provide more food and shelter for the species.

Sand gazelle

The counts of sand gazelle increased from counts in previous years (Simkins and Hammer 2018 and other expedition reports), as well as the regular DDCR counts, and can be considered an accurate estimate of the population within the DDCR. Predicted distribution has expanded from that of 2017; however, the concentrations are consistently in the south of the DDCR and correlate to a concentration of individuals at Tawi Ghadier irrigated area (see Figure 2.3d).

Large shrub survey

A repeat survey following the 2017 methodology described in Simkins and Hammer (2018) counted nearly 8,500 plants during circular observations. The dominant species was the fire bush (8131), followed by congregated ghaf trees (264), widely distributed Acacia trees (64) and Sodom's apple (31). Date palms were not counted in 2018.

Predicted distribution of the two shrub species (fire bush and Sodom's apple), which are both important indicator species for the reserve's habitats was not as accurate as in 2017, because the perimeter quadrants were not surveyed due to a smaller expedition team; this led to a reduction in the predicted distribution away from the perimeter (see Figures 2.3e & f). This is particularly noticeable in the northwest of the DDCR and along the eastern boundary.

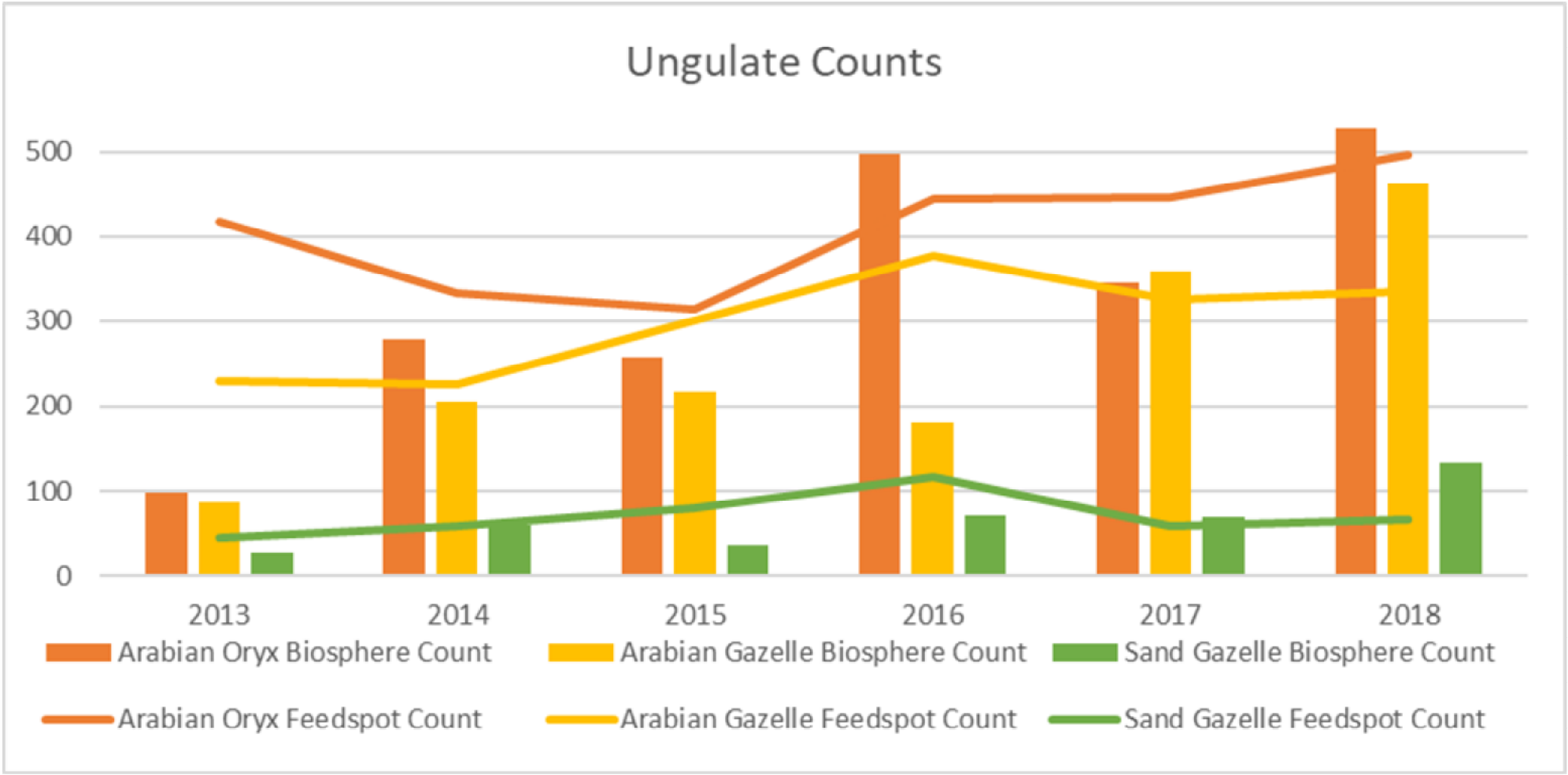


**Figure 2.3a.** Comparative chart of ungulate numbers recorded by the expedition (intensive survey of one week duration, once a year) And DDCR feedspot counts (during the same week as the expedition).

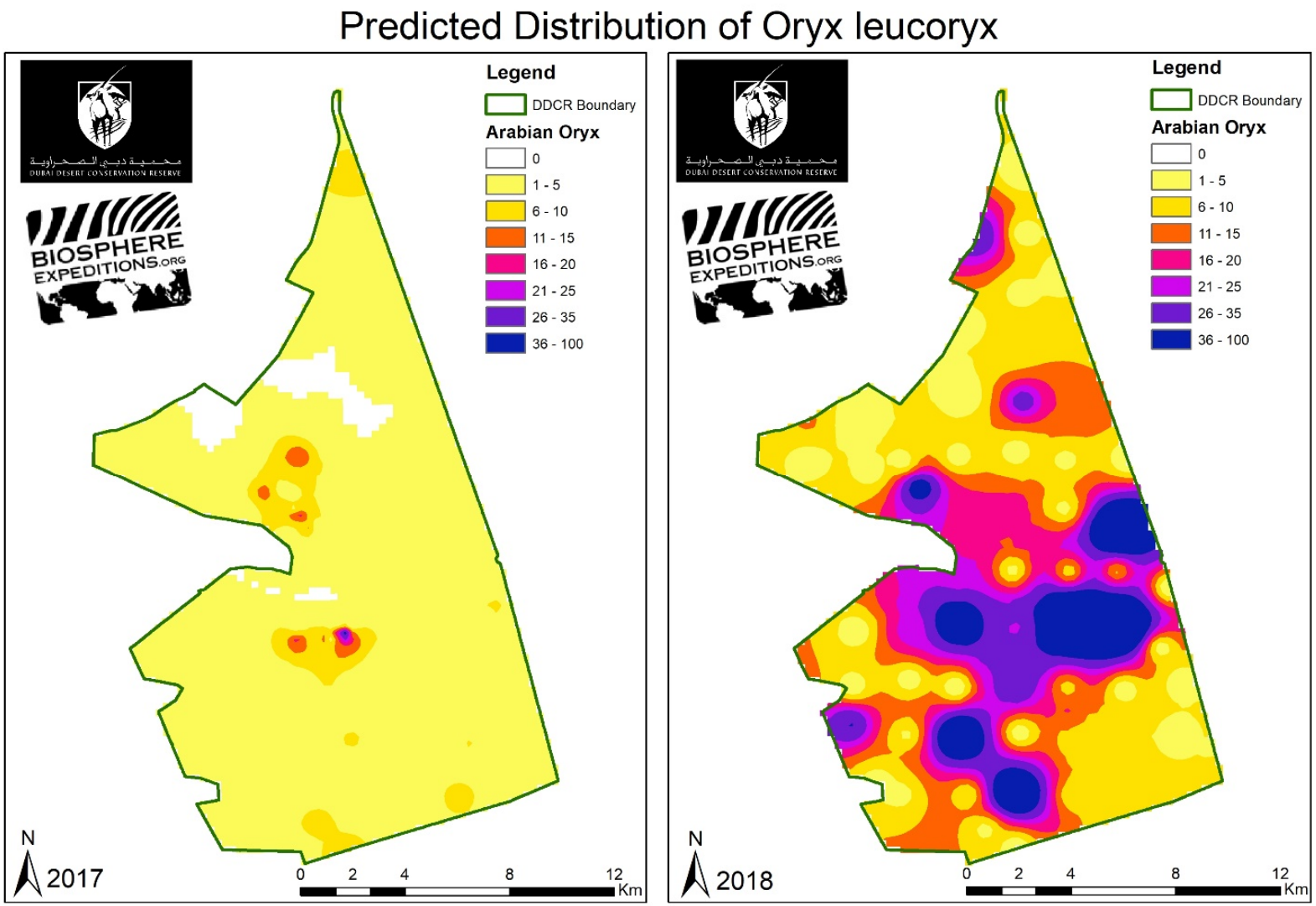


**Figure 2.3b.** Arabian oryx distribution 2017 vs. 2018. Predicted distribution calculations are based on a combination of both random and circular observation data.

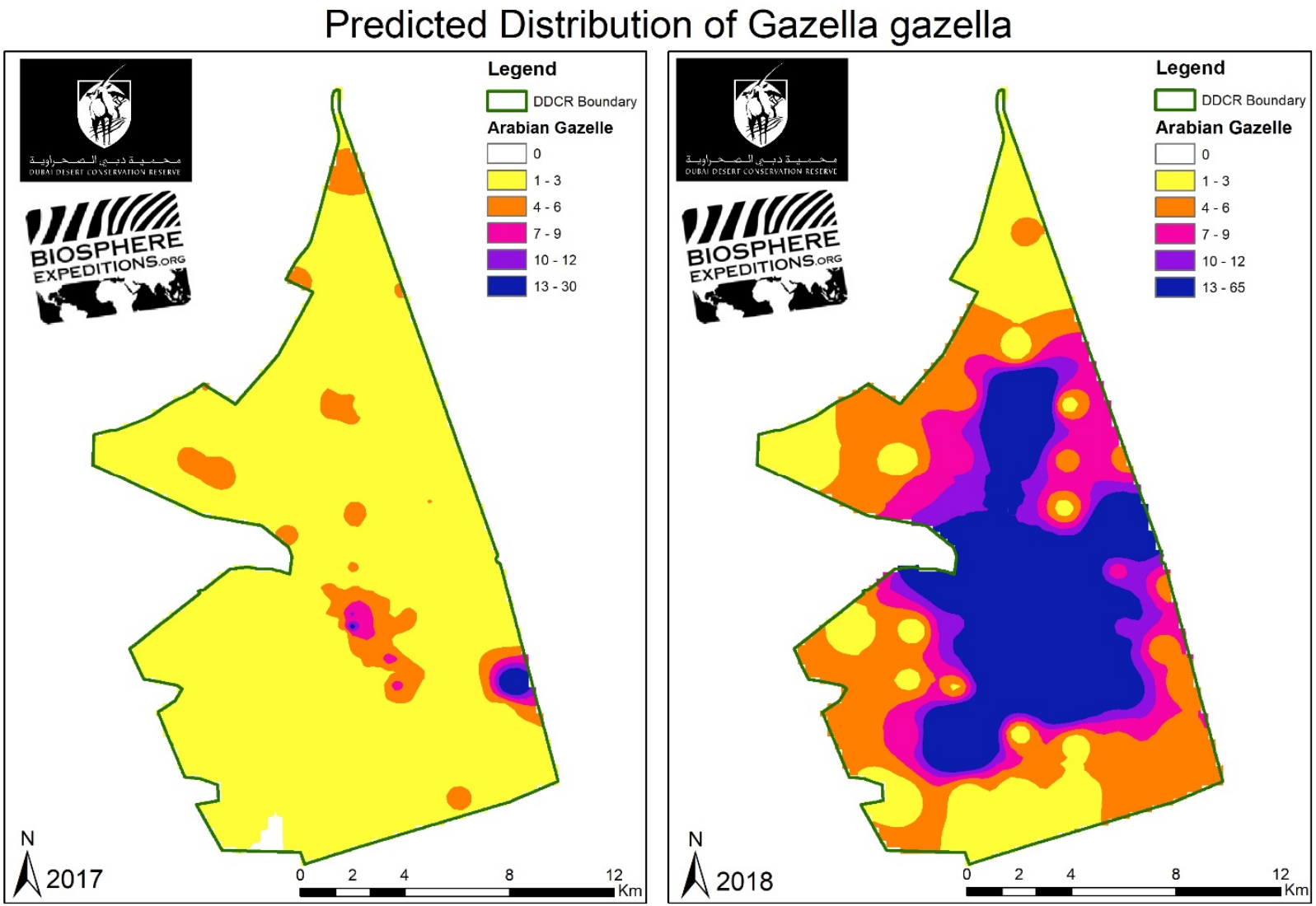


**Figure 2.3c.** Arabian gazelle distribution 2017 vs. 2018. Predicted distribution is based on observation data.

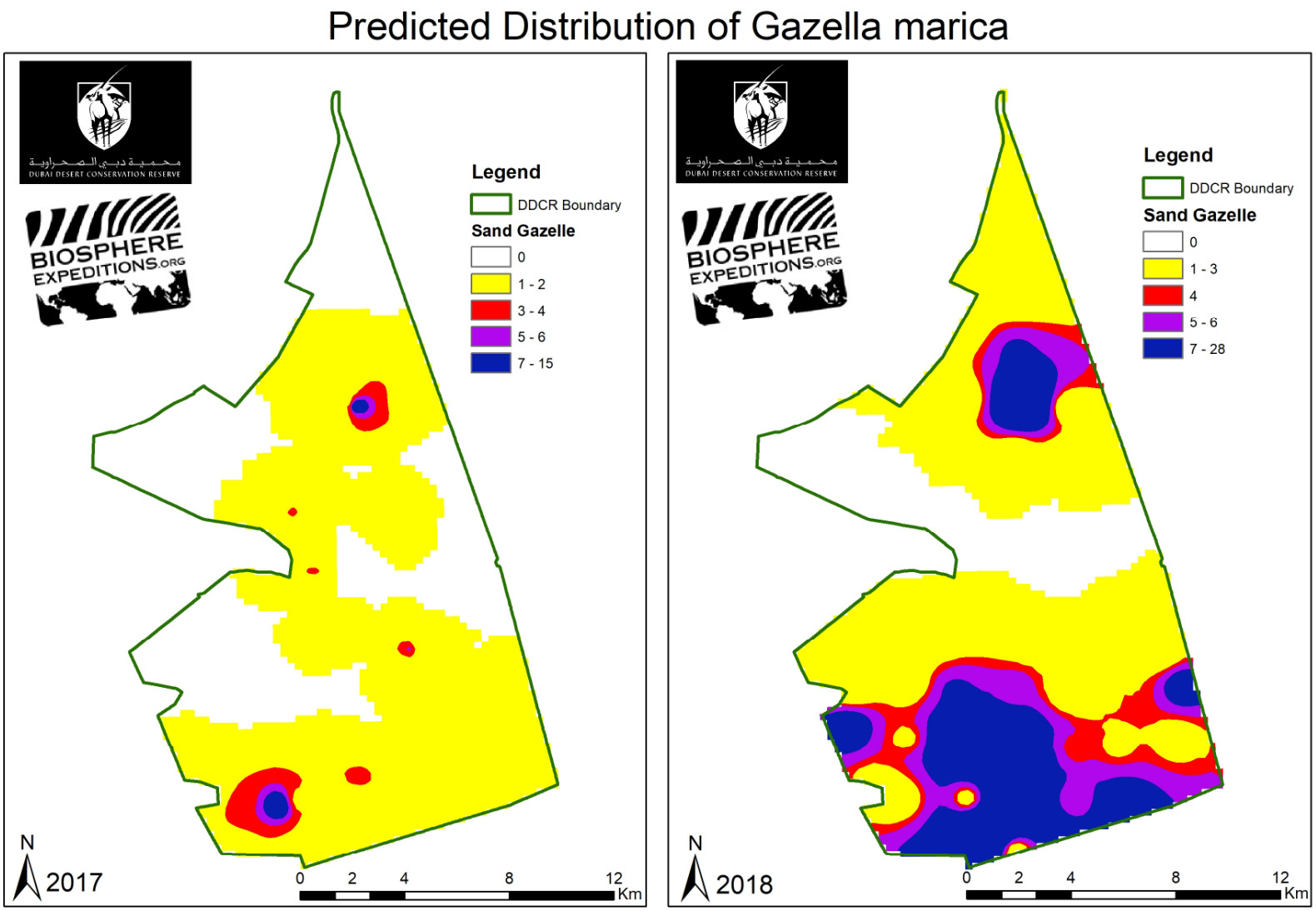


**Figure 2.3d.** Sand gazelle distribution 2017 vs. 2018. Predicted distribution calculations are based on observation data.

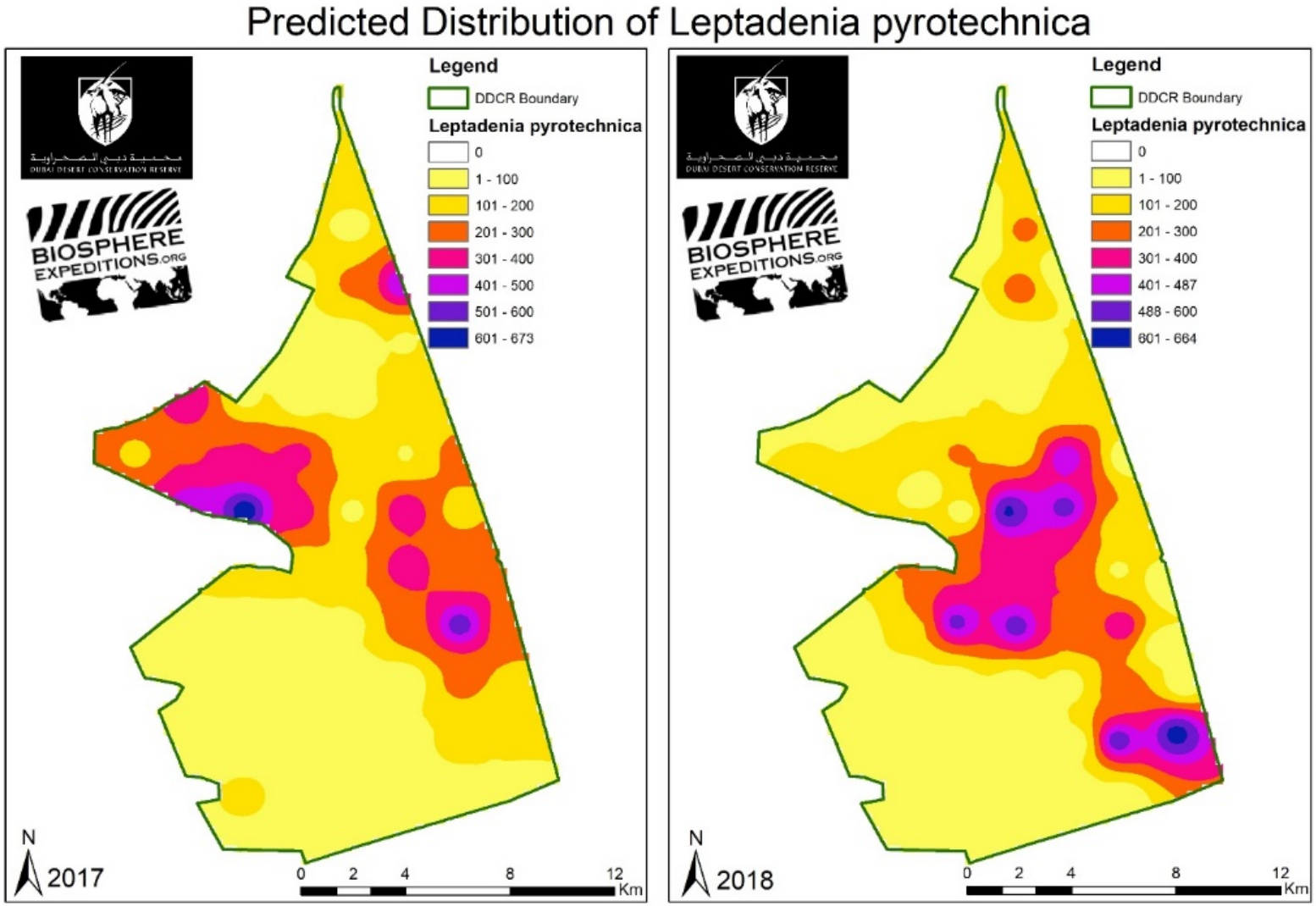


**Figure 2.3e.** Fire bush distribution 2017 vs. 2018. Predicted distribution calculations are based on observation data.

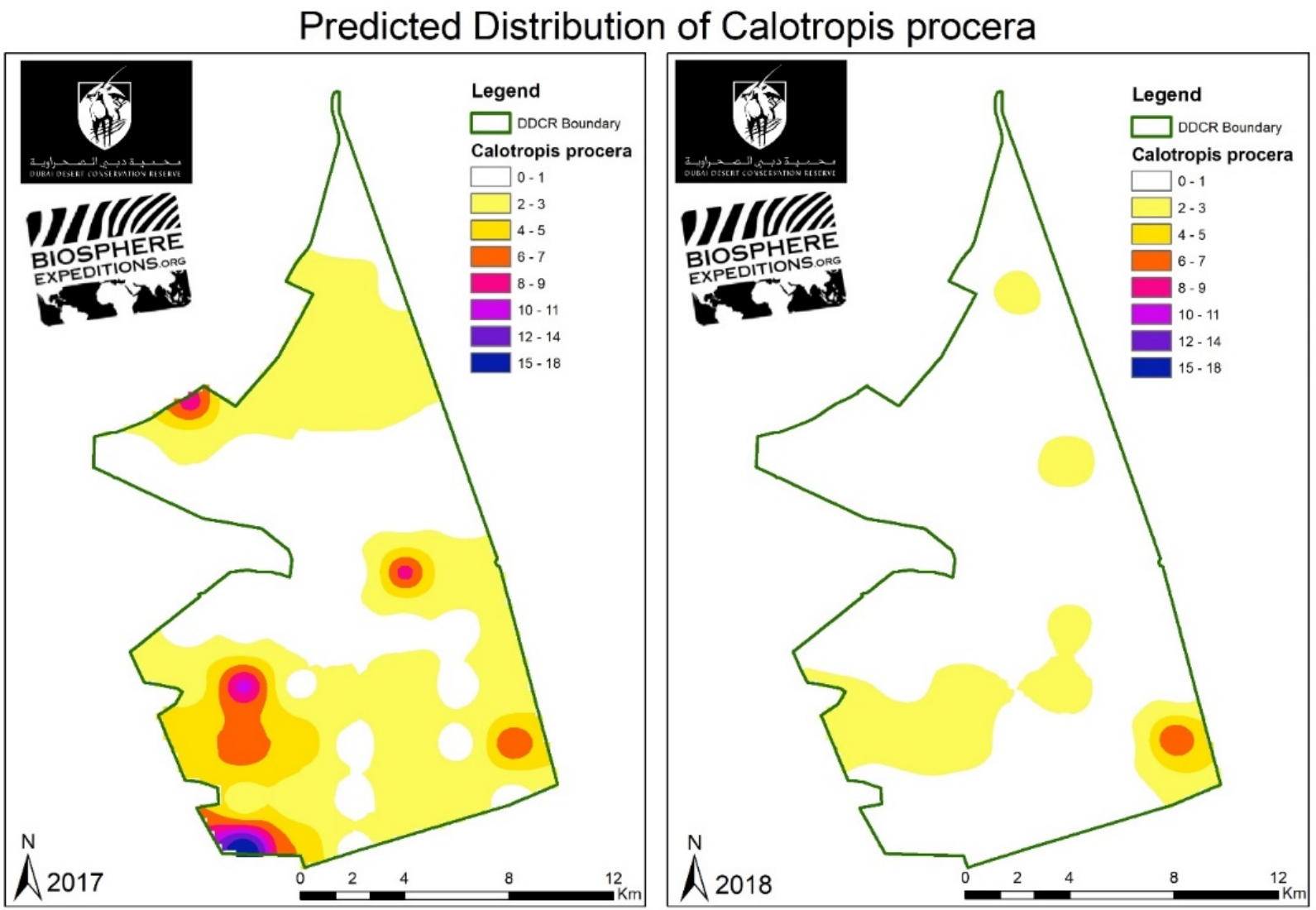


**Figure 2.3f.** Sodom's apple distribution 2017 vs. 2018. Predicted distribution calculations are based on observation data.

Live traps for medium-sized animals

Three traps were set for five nights for a total of 15 trap nights. The 2018 expedition had more success than the 2017 expedition when no captures were made (Simkins and Hammer 2018). In 2018, tracks of the target species were observed at all trap locations. There was also one unsuccessful trigger and three captures. The Northern trap was triggered with no capture, but with evidence of fox presence. The Southern trap captured a feral cat on the second night. The Central trap had two captures of a target species, namely the Arabian red fox on the first and last nights.

Arabian red fox den survey

Results of the survey can be found in Table 2.3b. The 2018 survey shows a 54% reduction in the number of active dens compared to 2017, of which seventeen were abandoned and ten became inactive. However, two inactive and two abandoned dens became active once again. This, together with eleven previously abandoned dens becoming inactive shows us that old dens are being reused. There were fifteen new den sites (seven active, and eight Inactive) discovered in 2018 compared to 38 new sites found in 2017 (Simkins and Hammer 2018). Note that new abandoned is not included in the 38, because by definition an abandoned den is a collapsed den with no evidence of fox activity.

**Table 2.3b.** Results of the Arabian red fox den surveys in 2011 and 2016-2018.

| Status | 2011 | 2016 | 2017 | 2018 |
|---|---|---|---|---|
| Active | 66 | 59 | 24 | 11 |
| Inactive | 95 | 52 | 40 | 42 |
| Abandoned | 0 | 57 | 138 | 167 |
| **TOTAL** | **161** | **168** | **202** | **220** |
| Status changes | | | | |
| Unchanged | | 55 | 65 | 138 |
| New Active | | 4 | 14 | 7 |
| Inactive to Active | | 25 | 2 | 2 |
| Abandoned to Active | | 0 | 0 | 2 |
| New Inactive | | 3 | 24 | 8 |
| Active to Inactive | | 24 | 3 | 10 |
| Abandoned to Inactive | | 0 | 5 | 11 |
| New Abandoned | | 0 | 7 | 0 |
| Active to Abandoned | | 12 | 43 | 17 |
| Inactive to Abandoned | | 45 | 39 | 25 |
| Not Surveyed | | 0 | 11 | 10 |

High den densities were, as expected, within relatively well-vegetated areas, dominated by large shrubs, in particular *Leptadenia pyrotechnica,* which meet the habitat requirements of providing a stable soil substrate supported by the shrub's root system. Changes in den densities from 2017 to 2018 (Figure 2.3g) show a concentration of dens, but a reduction in overall distribution. This may be due to a decrease in the availability of food, as rodent population decreased with a prolonged dry period, resulting in larger fox ranges to procure enough food.

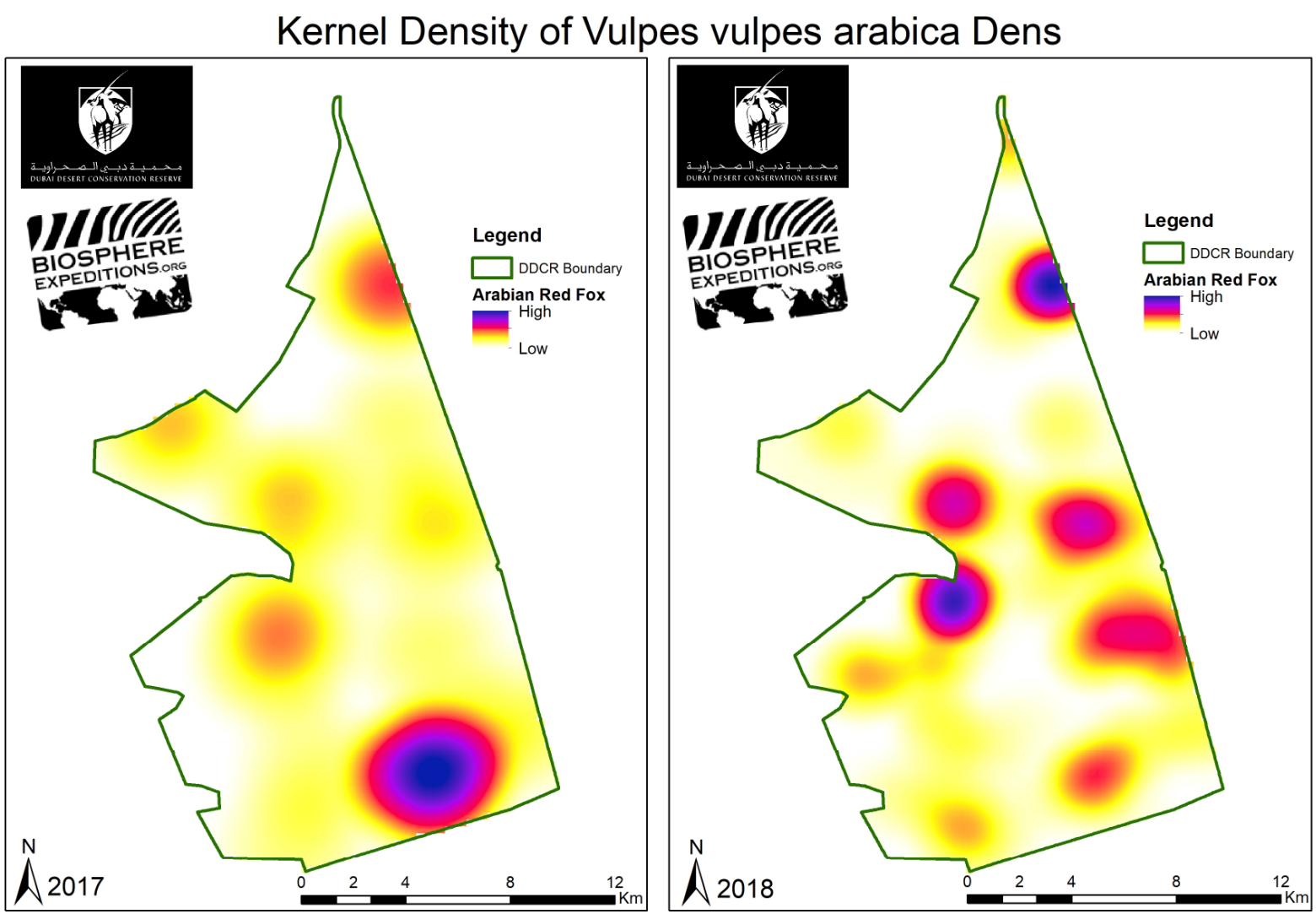


**Figure 2.3g.** Arabian red fox den distribution in 2017 and 2018.

Camera trapping

Of the 17 traps set, there were three traps that failed to produce any wildlife photos. However, they were active during the survey period and as such counted towards the camera trapping effort. A total of 85 trapping days captured 4,581 images of which 4,001 were images containing an identifiable subject. 3,084 individual records of naturally occurring fauna were recorded, as well as 1,998 humans or vehicles (see Fig. 2.3h). Fourteen wildlife species were captured.

A high number of bird species (9) were recorded this year. The most significant bird captures were the 134 lappet-faced vultures counted in all the photos from two traps and a rare record, only the third ever, of a cinereous vulture.

Arabian oryx was the most abundant and widespread species, recorded with 2,194 captures counted in all the photos from ten of the seventeen traps. High numbers of Eurasian collared doves (330) were also captured, nearly all at camera trap 19. Of the target species, 258 Arabian gazelle from nine traps, 18 sand gazelle from three traps, 13 Arabian red fox from three traps, and 5 Arabian hare from one trap were recorded. No Gordon's wildcat or sand fox were recorded by camera traps.

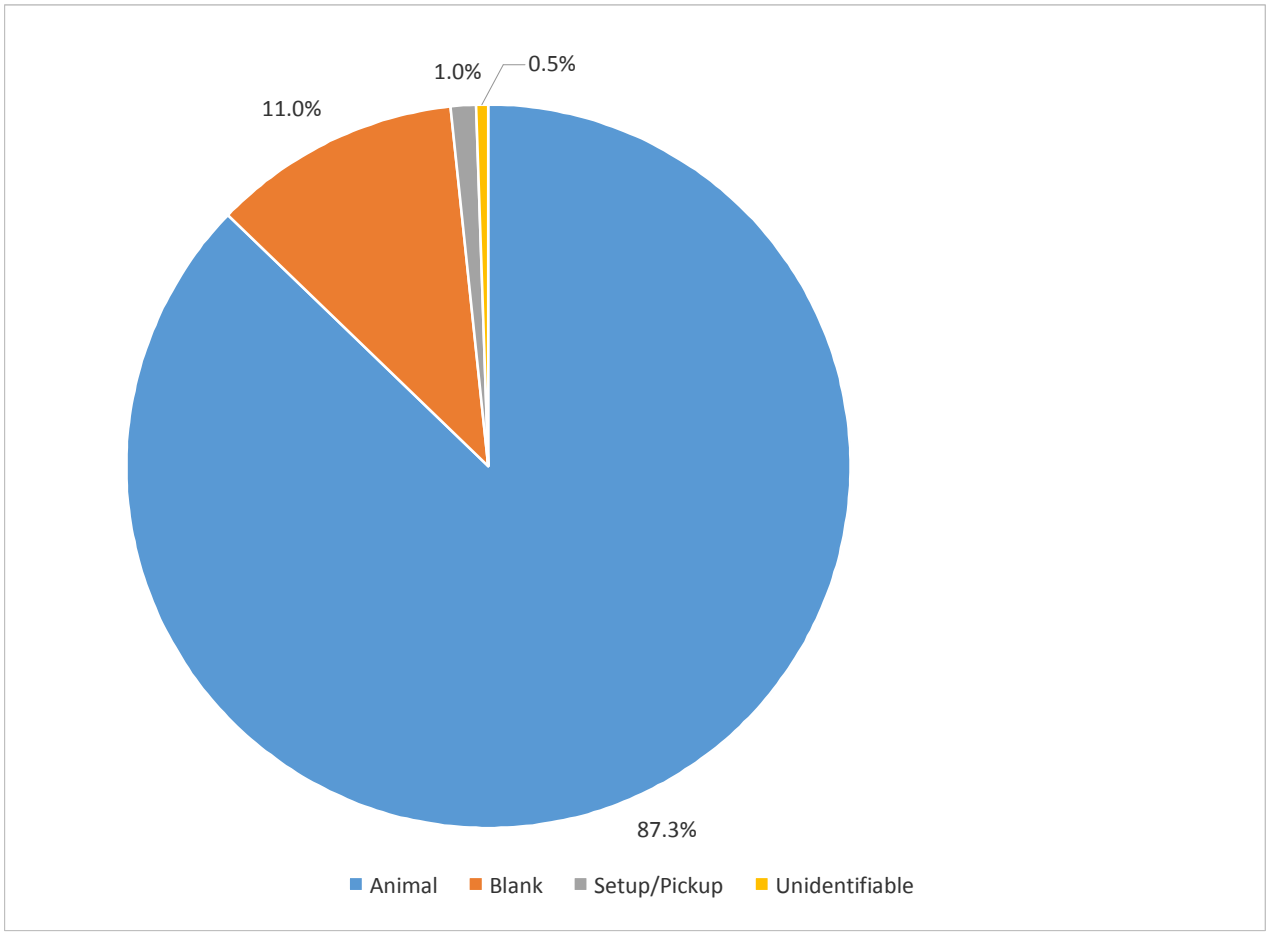


**Figure 2.3h.** Results of camera trapping 2018.

**Table 2.3c.** Results of camera trapping 2018.

| Camera trap name | Latitude | Longitude | Arabian oryx | Arabian gazelle | Sand gazelle | Arabian red fox | Arabian hare | Eurasian collared dove | Laughing dove | Lappet-faced vulture | Cinereous vulture | Crested lark | Red-wattled lapwing | Black-winged stilt | Long-legged buzzard | Pallid harrier | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trap 02 | 55.66389 | 24.88336 | 0 | 36 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |
| Trap 03 | 55.66042 | 24.86912 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trap 04 | 55.66054 | 24.90088 | 1 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| Trap 05 | 55.67381 | 24.78927 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 4 | 0 | 0 | 21 |
| Trap 06 | 55.71772 | 24.77956 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| Trap 07 | 55.64754 | 24.76645 | 0 | 5 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| Trap 08 | 55.66289 | 24.98077 | 7 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| Trap 09 | 55.66778 | 24.87019 | 348 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 354 |
| Trap 11 | 55.65691 | 24.74121 | 291 | 26 | 9 | 3 | 0 | 0 | 16 | 128 | 26 | 42 | 0 | 0 | 3 | 3 | 547 |
| Trap 12 | 55.68714 | 24.80453 | 85 | 26 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 114 |
| Trap 13 | 55.65969 | 24.82021 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trap 14 | 55.71768 | 24.81928 | 300 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 308 |
| Trap 15 | 55.61371 | 24.88543 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trap 16 | 55.63482 | 24.85646 | 0 | 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 72 |
| Trap 17 | 55.70321 | 24.82072 | 856 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 856 |
| Trap 18 | 55.69982 | 24.84174 | 270 | 9 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 286 |
| Trap 19 | 55.61343 | 24.79554 | 0 | 56 | 0 | 0 | 0 | 327 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 416 |
| | | **Total** | **2194** | **258** | **18** | **13** | **5** | **330** | **49** | **134** | **26** | **42** | **5** | **4** | **3** | **3** | **3084** |

## 2.4. Discussion and Conclusions

DDCR ungulates (Arabian oryx, Arabian gazelle, sand gazelle)

The relatively high numbers of ungulates within the DDCR continue to be a challenge for the DDCR in terms of needing to balance the welfare of the individual animals with the health of the desert ecosystem. The supply of supplementary feed for the oryx herd addresses both these aspects, with additional food available for individuals while at the same time limiting the impact of overgrazing on the ecosystem. However, high levels of nutrition do result in good breeding and therefore exponential population growth, which is not sustainable in the long run. Management will continue to assess different options to reduce the number of ungulates on the reserve. These include translocation of animals to other reserves within the natural home range of the species and introduction of predators to reduce population growth.

Live traps for medium-sized animals

2018 was a successful year for the trapping for medium-sized mammals, especially over the short period of the expedition. The data collected from the captures, including size, weight and sex, add to the growing database of the target species within the DDCR.

Red fox den survey

The results of the red fox den survey have once again shown marked changes from the previous surveys in 2011, 2016 and 2017 with a reduction in the number of active dens. Possible explanations are a reduction in rodent food supply and concomitant expansion of ranges or variability in survey efforts. At this stage it is unclear what the root causes are and as such more intensive training of citizen scientists to ensure consistent survey effort, as well as continued monitoring of the red fox dens will form part of future expeditions. A continued decline in red fox dens could be indicative of a threat to the population within the reserve, which in turn may require a management intervention.

Camera trapping

The camera traps provided an excellent return of pictures, the majority of which were natural fauna. This included five photos of the nocturnal Arabian hare, but only 13 records of the Arabian red Fox. Photos of the lappet-faced vulture and a vagrant cinereous vulture using the waterhole for bathing are significant records for these species, of which little is known of their ecology in the Northern Arabian Peninsula. The rare and cryptic mammal species within the DDCR, namely Gordon's wildcat and sand fox, were once again unfortunately not recorded. Continued camera trap surveys are therefore still needed to monitor for their presence in the DDCR.

Management considerations

The DDCR management in 2017 received approval to translocate Arabian oryx from the reserve to other protected areas and zoological collections within the region. It was hoped that this would alleviate some of the pressure of a growing population on the environment. However, this has not proved sufficiently successful in 2017 to reduce or even maintain the oryx population size.

A project to analyse the genetic composition of the DDCR oryx population will be implemented in 2019 in order to best manage the genetic quality of the herd and place the emphasis on quality rather than quantity as a measure of a successful reintroduction programme.

Although currently herd management through the removal of animals from the DDCR is the priority, the reintroduction of an apex predator will continue to be explored to hopefully find a socially acceptable solution. An apex predator will restore a natural ecological process by putting top-down pressure on the ungulate population. Similar reintroductions elsewhere have also had numerous other benefits to the function of the eco-system (see Berger 2002, Weis et al. 2007).

The Arabian red fox will need to be closely monitored due to the sudden reduction in active dens. If any, relatively fresh, deceased foxes are found in the DDCR the opportunity to perform a post mortem should be undertaken to ascertain the cause of death, as disease could be a potential cause of the sudden decline.

**Recommended activities and actions for the 2019 expedition**

The kind of citizen science projects run by Biosphere Expeditions are ideally suited to the DDCR's research needs, which require a large area to be surveyed in a short period of time. Therefore:

- We will continue the quadrant survey with the circular observations in 2019, as this provides the DDCR management with valuable data collected on the size and distribution of many species across the entire reserve.

- Due to the drastic reduction of active dens, the red fox den survey will be of particular importance in 2019 again as continued declines in the number of active dens would be significant (and worrying) for the reserve's population of red fox. In 2019 only active and inactive dens will be surveyed and additional training will be provided on the identification of fox dens and their classification.

- Camera trapping will be continued as we survey the DDCR for the presence and distribution of Gordon's wildcat and sand fox.

- We will continue to do some live trapping for Gordon's wildcat as well as sand fox in the reserve with the emphasis being on the collection of morphological data of individuals within the DDCR.

- Finally, if there are enough citizen scientists in 2019, we will also implement a rodent survey to investigate the distribution of this valuable prey source for the small predators.

## 2.5. Literature cited


Bell, S., P. Roosenschoon, G. Simkins, M. Hammer and A. Stickler (2013a) Ways of the desert: conserving Arabian oryx, Gordon's wildcat and other species of the Dubai Desert Conservation Reserve, United Arab Emirates. Expedition report 2012 available via www.biosphere-expeditions.org/reports.

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**Appendix 1:** Expedition diary & reports

A multimedia expedition diary is available on http://biosphereexpeditions.wordpress.com/category/expedition-blogs/arabia-2018/

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