EXPEDITION REPORT

Expedition dates: 18 – 25 January 2020

Report published: December 2020

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 with citizen scientists collecting data for the ninth successive expedition from 18 to 25 January 2020.

The 2020 expedition's quadrant surveys recorded the following species from 256 random observations, 16 feed spot counts and 62 circular observations: 792 Arabian oryx *Oryx leucoryx*, 280 Arabian gazelle *Gazella arabica*, 95 sand gazelle *Gazella marica*, 18 Arabian great grey shrikes *Lanius excubitor aucheri*, 12 lappet-faced vultures *Torgos tracheliotos*, 9 MacQueen's bustards *Chlamydotis macqueenii*, 7 Arabian hares *Lepus capensis*, 7 greater hoopoe larks *Alaemon alaudipes* and 1 pharaoh eagle owl *Bubo ascalaphus*.

As the population size of ungulates in the fenced DDCR is pretty much known, the expedition concentrated its research work on elucidating animal distribution. Arabian oryx were distributed more in the west, central and south of DDCR, mainly around feed points, where forage is easily found. Arabian gazelles were concentrated in the central and central-south parts of the DDCR, mainly around irrigated areas, which provide more forage for the species. Of this species only 24 individuals were counted on the feed spots. Sand gazelles were mainly observed in sand dunes, as well as around the irrigated areas, where there is more forage to be found. Feed points seemed to be of little interest to the species in 2020, with only one individual recorded.

The expedition's Arabian red fox survey found 68 dens, of which 45 had previously been classified as active or inactive during the 2019 expedition, with an additional 23 newly identified dens. The 2020 surveys showed a decrease in the number of surveyed or identified active and inactive dens compared to 2019, but this may be due to the difficulty of this task for citizen scientists (at least 20 additional active dens were discovered after the 2020 expedition between February and March 2020). Red foxes were also recorded on four camera traps during the 2020 expedition. Due to the favourable vegetation conditions after the rains, the red fox prey base is likely to have improved in the reserve. All these are positive indicators for the status of the fox population inside the DDCR, even though the den surveys might suggest otherwise.

Live traps were set for 36 trap nights and only one feral cat was captured in the north, near Nazwa Mountain. No native meso-carnivore species were captured. Compared to previous years, we increased the number of traps from three to nine live traps. High rainfall and therefore higher prey base availability, which means that predators were less likely to be attracted to the baited traps, likely contributed to this low capture success rate.

Small mammal trapping comprised 239 trapping nights over six grids and resulted in a total of 31 capture-recaptures: 28 Cheeseman's gerbils *Gerbillus cheesmani* (20 males, 8 females) and 3 Baluchistan gerbils *Gerbillus nanus* (2 males, 1 female). Total trapping success rate was 13%. Small mammals were captured in all six grids.

Of the 16 camera traps set by the expedition, 10 were set close to artificial water sources, and 6 were set on natural sites. Two camera traps malfunctioned, one on each site type. A total of 80 camera trapping days captured 6,609 images, 6,119 with recognisable subjects, of which 5,546 were of native fauna, as well as 499 of humans or vehicles. Arabian oryx was the most abundant and widespread species with 13,244 recorded capture events (total number of oryx appearing in all the photos) from 11 camera traps. Among the target mammal species within the DDCR, the rare Arabian wildcat was recorded and confirmed for a second year in a row from the same location by camera trap. Arabian red fox was also recorded by four camera traps. Rare species records include Arabian hare and MacQueen's bustard. Sand fox, lappet-faced vulture and pharaoh eagle-owl were not recorded by camera trap in 2020.

Over the years the relatively high numbers of ungulates within the DDCR, especially the Arabian oryx, continue to be a challenge in terms of the need to balance animal welfare with the health of the desert ecosystem. Supplying supplementary feed for the Arabian oryx herd addresses both of these aspects by making additional food available to individuals while limiting the impact of overgrazing on the ecosystem. However, supplementary feeding also contributes to the continued growth of the gazelle populations, which are not sustainable because resources, natural and supplied, are limited. Therefore, in order to reduce the number of ungulates in the reserve, management has succeeded in gaining approval, and have started construction, of ungulate holding enclosures outside the reserve perimeter. Surplus animals will then be made available for translocation to other reserves within the natural home range of the species. A reduction in the ungulate population within the DDCR will hopefully lead to better vegetation and a distribution more dependent on habitat type and quality, rather than supplementary feed and enhanced (irrigated) habitats. Predator re-introduction has not been approved at this time by the authorities, but is still under consideration.

الملخص

يستمر التعاون الناجح بين محمية دبي الصحراوية وبرنامج بعثات المحيط الحيوي والتي بدأت منذ العام 2012م بمشاركة المتطوعين الذين يجمعون البيانات للرحلة التاسعة على التوالي من 18 إلى 25 يناير 2020م.

خلال مسوحات البعثة الاستكشافية لعام 2020م في جميع أقسام المحمية وبإستخدام طرق حصر مختلفة من خلال 256 ملاحظة عشوائية ، و 16 تعدادًا حول نقاط توزيع العلف و 62 تسجيل لإنواع من خلال التمثيل الدائري سجلت الأنواع التالية: 792 مها عربي ، 280 غزال عربي ، 95 غزال رملي ، 18 صرد جنوبي، 12 نسر اذن، 9 حبارى شرقية ، و 7 أرانب عربية ، وسبعة طيور المكاء ، وبومة صحراوية.
نظرًا للزيادة المضطردة المعروفة في أعداد قطعان المها والغزال في محمية دبي الصحراوية المسورة، فقد ركزت البعثة أعمالها البحثية على توضيح توزيعات تلك الأنواع. تم ملاحظة زيادة أعداد توزيع المها العربي بشكل أكبر في الغرب والوسط والجنوب من محمية دبي الصحراوية وبشكل رئيسي حول نقاط إمداد العلف حيث يسهل العثور على الغذاء. تركزت أعداد الغزال العربي في الأجزاء الوسطى والجنوب الوسطي من المحمية وبشكل رئيسي حول المناطق المروية من المزارع القديمة والتي بها وفرة في الغطاء النباتي و تم إحصاء 24 فردًا فقط في أماكن توزيع العلف. تم تسجيل ومشاهدة غزلان الريم بشكل رئيسي في الكثبان الرملية وكذلك حول المناطق المروية من المزارع القديمة حيث يوجد وفرة في الغطاء النباتي ولم تكن نقاط التغذية ذات أهمية كبيرة لغزال الريم في عام 2020م حيث تم تسجيل فقط فرد واحد من غزال الريم حول نقاط إمداد العلف.

أظهرت استطلاعات تسجيل أوكار الثعلب الأحمر العربي للبعثة انخفاضًا في عدد الأوكار النشطة وغير النشطة التي تم مسحها أو تحديدها مقارنة بعام 2019م، وقد يكون هذا الإنخفاض بسبب صعوبة هذه المهمة للمتطوعين حيث أنه قد تم اكتشاف عدد عشرين من الأوكار النشطة الإضافية على الأقل بعد الإنتهاء من البعثة بين شهري فبراير ومارس 2020م. تم تسجيل الثعالب الحمراء أيضًا من خلال أربعة مصائد للكاميرات خلال رحلة 2020م. نظرًا لظروف الغطاء النباتي المواتية بعد هطول الأمطار، فمن المحتمل أن تكون أعداد الثعلب الأحمر قد تحسنت في المحمية. كل هذه مؤشرات إيجابية لحالة تعداد الثعالب داخل محمية دبي الصحراوية على الرغم من الاستطلاعات قد تشير إلى خلاف ذلك.

تم وضع العديد من المصائد الحية لمدة 36 ليلة وكان نتيجة لذلك تسجيل عدد قط وحشي واحد في الشمال بالقرب من جبل نزوى. لم يتم تسجيل أي مفترسات متوسطة الحجم أخري مقارنة بالسنوات السابقة بالرغم من زيادة عدد المصائد من ثلاثة إلى تسعة مصائد حية. من المحتمل أن يكون هطول الأمطار الغزيرة وبالتالي توفر غذاء أكبر من الفرائس مما أدي أن الحيوانات المفترسة كانت أقل إنجذابا إلى المصائد المزودة بطعم مما ساهم في إنخفاض أعداد المفترسات.

أشتمل برنامج مصائد الثدييات الصغيرة على ما مجموعه 239 ليلة في ست مواقع مختلفة وأسفرت عن ما مجموعه 31 عملية أسر: 28 جربوع تشيزماني (20 ذكورًا و 8 إناث) و 3 جربوع بلوشستان (أثنين ذكور وإنثي واحدة) كان إجمالي معدل نجاح الاصطياد 13٪ حيث تم تسجيل الثدييات الصغيرة في جميع مواقع الدراسة.

من بين إجمالي ستة عشر مصائد الكاميرا وضعتها البعثة خلال 2020م تم تركيب عشرة مصائد كاميرات بالقرب من مصادر المياه الاصطناعية وستة تم وضعها في مواقع طبيعية. تعطلت عدد أثنين من مصائد الكاميرا خلال فترة الدراسة واحدة في كل موقع (مصادر المياه والمناطق الطبيعية). تم التقاط ما مجموعه 80 يومًا من أيام مصائد الكاميرات وتسجيل ما مجموعه 6609 صورة، منها 6119 صورة مع أهداف يمكن التعرف عليها ومنها 5546 من الحيوانات البرية بالإضافة إلى عدد 499 صورة لبشر أو لمركبات. كان المها العربي أكثر الأنواع وفرة وانتشارًا حيث تم تسجيل 13244 إجمالي عدد المها العربي الظاهر في جميع الصور من 13 مصيدة كاميرا. من بين أنواع الثدييات المستهدفة في DDCR تم تسجيل القط البري العربي النادر وتأكيده للعام الثاني على التوالي من نفس الموقع بواسطة مصيدة كاميرا. كما سجلت أربعة مصائد للكاميرا للثعلب الأحمر العربي. وكذلك تسجيل الأنواع النادرة الأخرى مثل الأرنب العربي وطائر الحبارى. لم يتم تسجيل الثعلب الرملي ونسر الأذون والبومة الصحراوية الفرعونية بواسطة مصيدة الكاميرا في عام 2020م.

على مر السنين ، لا تزال الأعداد المرتفعة نسبيًا من ذوات الحوافر داخل محمية دبي الصحراوية وخاصة المها العربي تمثل تحديًا من حيث الحاجة إلى تحقيق التوازن بين أعداد الحيوان وصحة النظام البيئي الصحراوي. إن توفير العلف التكميلي لقطيع المها العربي يعالج كلا الجانبين من خلال توفير الطعام البديل مع الحد من تأثير الرعي الجائر على النظام البيئي. ومع ذلك، تساهم التغذية التكميلية أيضًا في النمو المستمر لأعداد الغزال والتي لا يمكن استدامتها لأن الموارد الطبيعية شحيحة. لذلك، ومن أجل تقليل عدد ذوات الحوافر في المحمية ، نجحت الإدارة في الحصول على الموافقة وبدأت في إنشاء مسيجات للاحتفاظ بالحيوانات خارج أسوار المحمية. سيتم بعد ذلك إتاحة الفرصة لنقل الحيوانات الزائدة إلى محميات أخرى ضمن النطاق المحلي الطبيعي للأنواع. من المأمول أن يؤدي انخفاض أعداد المها العربي داخل المحمية إلى تحسين جودة الغطاء النباتي والتوزيع المتجانس للحيوانات الرعوية والذي يعتمد بشكل أكبر على نوع الموائل وجودتها ، بدلاً من الأعلاف التكميلية والموائل المحسنة (المروية). لم تتم الموافقة على إعادة إدخال أي نوع من المفترسات في هذا الوقت من قبل السلطات ولكنها لا تزال قيد النظر.

Contents

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.

The aim of the expedition was to survey the distribution of Arabian oryx *Oryx leucoryx*, sand gazelle *Gazella marica* and Arabian gazelle *Gazella gazella*, as well as to survey dens of Arabian red fox *Vulpes vulpes arabica*, monitor the small mammal population and to record cryptic and rare species of the Dubai Desert Conservation Reserve. Target species in addition to the ones mentioned were Arabian wildcat *Felis lybica lybica*, sand fox *Vulpes rueppellii*, MacQueen's bustard *Chlamydotis macqueenii*, lappet-faced vulture *Torgos tracheliotos*, pharaoh eagle-owl *Bubo ascalaphus*; and new target species from this expedition onwards are the greater hoopoe-lark *Alaemon alaudipes* and the Arabian great grey shrike *Lanius excubitor aucheri*. Methods to encounter species were (a) circular observations, (b) feed point surveys and (c) random encounters.

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 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 the 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.

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 pharaoh eagle-owl and two groves of rare Ghaf trees (*Prosopis cineraria*). There are also some former farms with tree plantations within the DDCR as a legacy of the time before it became a reserve. 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 850 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 gazelles can now be seen throughout 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.

1.3. Dates & team

The annual survey ran over a week in January 2020 with a team of national and international citizen scientists, professional scientists and an expedition leader. Group dates were as shown in the team list below.

Figure 1.3a. The 2020 expedition team.

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

18 – 25 January 2020: Shamsa Alfalasi (UAE), Wing Kee Chu (Canada), Ellen Craig (USA), Peter Goodman (UK), Robin Johnson (Romania), Petra Loebel (Germany), Lorna Mikhelson (UK), Anette Prelle (Germany), Yvonne Reinert (Germany), Peter Thoem (Canada), Jens Thomas (Germany), Madeleine van Lieshout (Netherlands), Toby Whaley (Germany), Albert Wierenga (Canada), Ellen Williams (USA).

A medical umbrella, safety and evacuation procedures were in place, but did not have to be invoked as there were no incidences.

Moayyed Sher Shah, the expedition scientist, holds a zoology degree from Islamia University Bahawalpur, Pakistan. After years of working as a zoologist and conservationist in Saudi Arabia, he joined the Dubai Desert Conservation Reserve as a conservation officer in 2018. His main role is to plan, control, develop and regularly monitor the conservation practices and environmental work within the DDCR, ensuring the restoration and well-being of the flora and fauna. He was supported by Greg Simkins, conservation manager for the DDCR, and Tamer Khafaga, DDCR conservation research manager.

The expedition leader was Amadeus DeKastle, who has been living and working in Kyrgyzstan since 2009. Born in Germany and with a US passport, he holds a Master's degree in entomology from the University of Nebraska. He currently works with the NGO Plateau Perspectives in environmental conservation with a number of citizen science research projects. He is also a part-time lecturer at the American University of Central Asia in the Environmental Management Department. In 2014, he found out about Biosphere Expeditions' work in Kyrgyzstan and signed up for a placement. After two years of volunteering with Biosphere Expeditions, he decided to jump in with both feet and joined the team in 2016.

1.4. 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.

1.5. 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. Thank you also to anonymous reviewers for helpful comments on drafts of this report.

1.6. Expedition budget

Each team member paid towards expedition costs a contribution of € 1,480 per person for the 8-day slot. The contribution covered accommodation and meals, supervision and induction, special research 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., or visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how this contribution was spent are given below.

Income	€
Expedition contributions	20,100
Expenditure	
Staff includes local and Biosphere Expeditions staff salaries and travel expenses	2,879
Research includes research materials & gear etc. purchased internationally & locally	2,505
Transport includes hire cars, fuel, taxis in the UAE	1,613
Expedition base includes all food & services	1,413
Administration includes miscellaneous fees & sundries	687
Team recruitment Arabia as estimated % of annual PR costs for Biosphere Expeditions	6,668
Income – Expenditure	**4,435**
Total percentage spent directly on project	**78%**

1.7. 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.

Enquires should be addressed to Biosphere Expeditions at the address given on the website.

2. Desert species surveys

2.1. Introduction and background

The United Arab Emirates, and Dubai in particular, are well known for their 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 from 2012 to 2018 and background to the species under investigation are covered in Bell & Hammer (2015) and Simkins & Hammer (2018, 2019), as well as annual expedition reports from 2012 onwards.

2.2. Survey aims

The 2020 expedition conducted five monitoring surveys:

1. Species encounter surveys in quadrants
   to understand the distribution of the three ungulate species and other target species in DDCR.
2. Live trapping of medium-sized animals
   to elucidate the current population status of Arabian wildcat and both fox species in the DDCR and to collect morphological data from captured individuals.
3. Arabian red fox den surveys
   to monitor population changes of the DDCR's largest predator species through their den use.
4. Small mammal trapping
   to elucidate the population status of rodent species in different habitats over time in the DDCR.
5. Camera trapping
   to record nocturnal and cryptic species.

2.3 Survey design and training of citizen scientists

Training for each survey was given separately and immediately before starting the survey, and conducted during the first three days of the expedition to aid intake and retention of information. Presentations about identification of ungulate and other target species were part of the training sessions on the first day. Surveys were conducted in four zones, namely North, Central, South and Perimeter Zones (Figure 2.3a). Each zone comprised fifteen 2 x 2 km quadrants, with only the Perimeter Zone having 17 partial quadrants. These 62 quadrants together represent approximately 214 km², or 95%, of the 225 km² of the DDCR and included all key habitats of vegetated dunes, sand dunes and gravel plains. In addition to these surveys, participants were tasked to record any animal species observed while in the field.

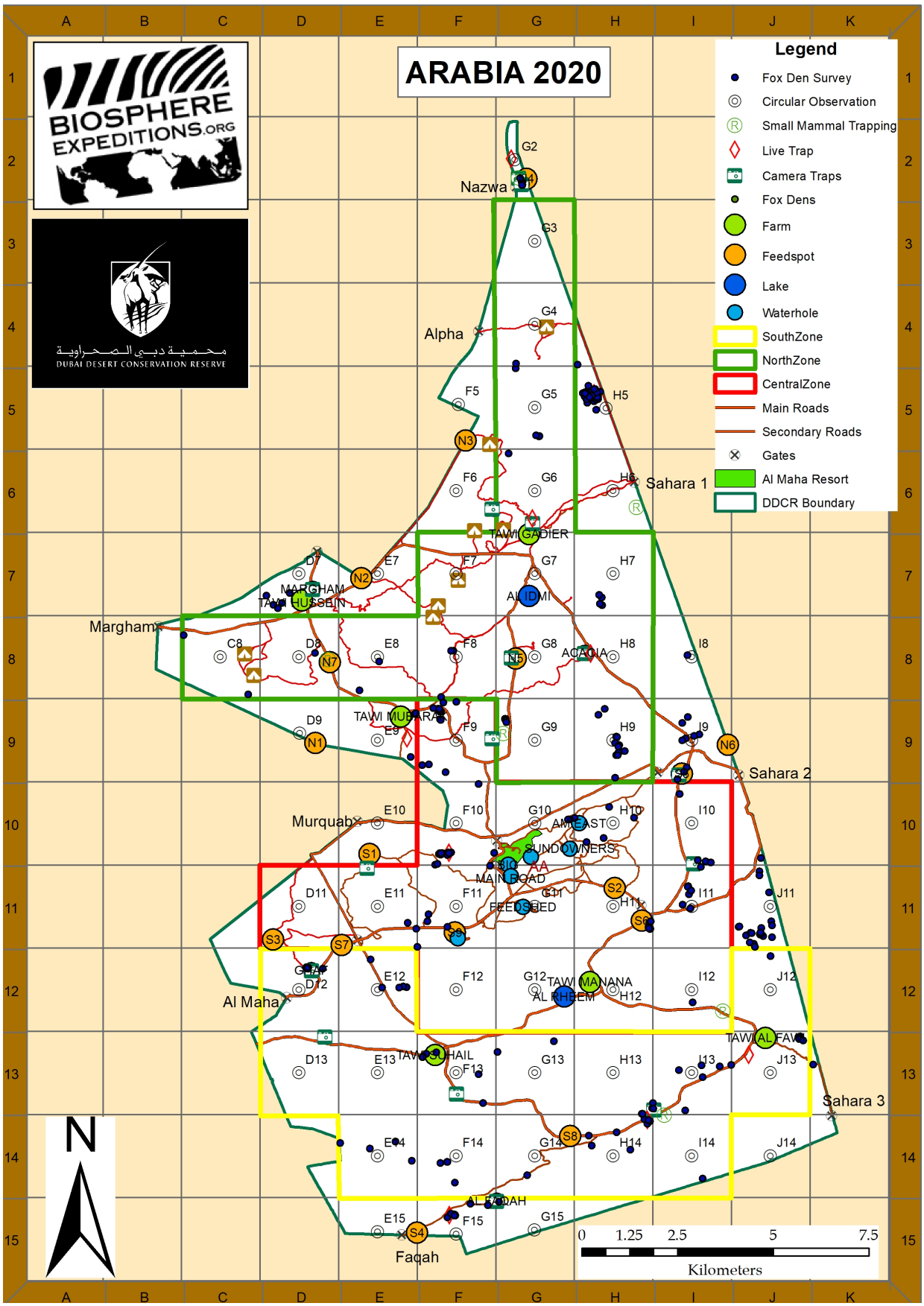


Figure 2.3a. The DDCR and its survey zones (North = green, Central = red, South = yellow). The Perimeter Zone comprises all other zones within the DDCR.

2.4. Species encountered overall

Table 2.4a shows all species encountered during the 2020 expedition. Encounter methods include sightings, live and camera trapping as indicated.

Table 2.4a. Species encountered during the expedition. Starred* species denotes expedition target species.

Common name	Scientific name	Encounter method		
		Sighting	Live trap	Camera trap
Birds				
Grey francolin	*Francolinus pondicenanus*	X		X
Egyptian goose	*Alopochen aegyptiaca*	X		
Little grebe	*Tachybaptus ruficollis*			X
Lappet-faced vulture	*Torgos tracheliotos**	X		
Pallid harrier	*Circus macrourus*	X		
Shikra	*Accipiter badius*	X		
Long-legged buzzard	*Buteo rufinus**	X		
Common Kestrel	*Falco tinnunculus*	X		
Peregrine Falcon	*Falco peregrinus*	X		
MacQueen's bustard	*Chlamydotis macqueenii**	X		X
Common moorhen	*Gallinula chloropus*	X		
Red-wattled lapwing	*Vanellus indicus*	X		X
Plover sp.				X
Green sandpiper	*Tringa ochropus*	X		X
Chestnut-bellied sandgrouse	*Pterocles exustus*	X		
Feral pigeon	*Columba livia*	X		X
Eurasian collared dove	*Streptopelia decaocto*	X		X
Laughing dove	*Spilopelia senegalensis*	X		X
Rose-ringed parakeet	*Psittacula krameri*	X		
Pharaoh eagle-owl	*Bubo ascalaphus*	X		
Eurasian hoopoe	*Upupa epops*	X		
Blue-cheeked bee-eater	*Merops persicus*	X		
Arabian great grey shrike	*Lanius excubitor aucheri**	X		X
Arabian babbler	*Turdoides squamiceps*	X		
Brown-necked raven	*Corvus ruficollis*	X		
White-eared bulbul	*Pycnonotus leucogenys*	X		
Greater hoopoe-lark	*Alaemon alaudipes**	X		
Crested lark	*Galerida cristata*	X		
Sand martin	*Riparia riparia*	X		
Asian desert warbler	*Sylvia nana*	X		
Warbler sp.		X		
Common mynah	*Acridotheres tristis*	X		
Eastern black redstart	*Phoenicurus ochruros*	X		
Desert wheatear	*Oenanthe deserti*	X		
House sparrow	*Passer domesticus*	X		
White wagtail	*Motacilla alba*	X		

Table 2.4. (continued). Species encountered during the expedition. Starred* species denotes expedition target species.

Common name	Scientific name	Encounter method		
		Sighting	Live trap	Camera trap
Arthropods				
Wolf spider	*Lycosidae sp.*	X		
Zig-zag orb spider	*Argiope sp.*	X		
Arabian fat-tailed scorpion	*Androctonus crassicauda*	X		
Dimorphic cockroach	*Blatta lateralis*	X		
Desert locust	*Schistocerca gregaria*	X		
Harlequin ground bug	*Lygaeus equestris*	X		
Silverfish	*Lepisma saccharinum*	X		
Desert runner (ant)	*Cataglyphis niger*	X		
Giant ant	*Camponotus xerxes*	X		
Arabian darkling beetle	*Pimelia arabica*	X		
Urchin beetle	*Priionotheca cornata*	X		
Highwayman (robberfly)	*Apociea femoaralis*	X		
Painted lady	*Vanessa cardui*	X		
Mammals				
Arabian oryx	*Oryx leucoryx**	X		X
Arabian gazelle	*Gazella arabica**	X		X
Sand gazelle	*Gazella marica**	X		X
Arabian wildcat	*Felis lybica lybica*			X
Arabian red fox	*Vulpes vulpes arabica**	X		X
Feral cat	*Felis catus*	X	X	
Arabian hare	*Lepus capensis*	X		X
Cheeseman's gerbil	*Gerbillus cheesmani*		X	
Baluchistan gerbil	*Gerbillus nanus*		X	
Reptiles				
Arabian toad-headed agama	*Phrynocephalus arabicus*	X		
White spotted lizard	*Acanthodactylus schmidti*	X		
Hadramaut sand lizard	*Mesalina adramitana*	X		
Fringe-toed sand lizard	*Acanthodactylus gongrorhynchatus*	X		
Least semaphore gecko	*Pristurus minimus*	X		
Dune sand gecko	*Stenodactylus doriae*	X		
Sandfish	*Scincus scincus*	X		
Schokari sand racer	*Psammophis schokari*	X		

2.5. Species encounter surveys in quadrants

2.5.1 Methods of species encounter surveys in quadrants

This method records species encountered during (a) circular observations, (b) feed point surveys and (c) random encounters.

In a nutshell, weekly feed point counts are made on the main tracks or roads in the reserve by DDCR staff while providing animal feed in the morning, so this will only count animals along the main tracks (roads) going to the feed points, water holes and farms. In contrast, during the expedition's circular observations, citizen scientists walked to the centre of each quadrant to observe and record the animals there, which provides a clearer picture of animal distribution. This, combined with the counts made by DDCR staff and also those by the expedition at feed points, yields a good overall picture of animal distribution and numbers in the reserve.

Figure 2.5.1a. A survey team conducting a circular observation.

For the circular observation, a team of three to four citizen scientists selected one observation point, which provided a good vantage point, within 300 m of the centre of the quadrant, which was marked on a GPS. From this vantage point, they recorded all species and their individuals seen by eye or through binoculars within 30 minutes and 360º (see Figure 2.5.1a.). The survey was conducted between 08:30 and 15:00 over two days, covering all 62 quadrants (214 km²), 30 on 19 January and 32 on 20 January 2020.

Feed spot counts were carried out for ungulate and other target species within each quadrant by counting animals at feed spots (Figure 2.5.1b) for 15 minutes by three to four observers positioned 20-50 metres from the feed spot.

Figure 2.5.1b. A feed point count.

Random encounters were those made during the expedition when not conducting another survey in each quadrant during the two days when circular observations were conducted in each quadrant or whilst driving to set a camera trap or on supply runs.

Species observed during the three types of surveys were recorded in the datasheets as follows: species name, GPS 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, and ecological information such as number of animals (group size), sex, age, behaviour and any additional comments.

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.

2.5.2 Results of species encounter surveys in quadrants

From 256 random observations, 16 feed spot counts and 62 circular observations, we observed 792 Arabian oryx, 280 Arabian gazelle, 95 sand gazelle, 18 Arabian great grey shrikes, 12 lappet-faced vultures, 9 MacQueen's bustards, 7 Arabian hares, 7 greater hoopoe-larks and 1 pharaoh eagle owl.

Ungulate species survey

Figure 2.5.2a shows the 2020 results of the expedition's ungulate distribution surveys as a percentage of the estimated DDCR population as determined from the weekly DDCR staff counts.

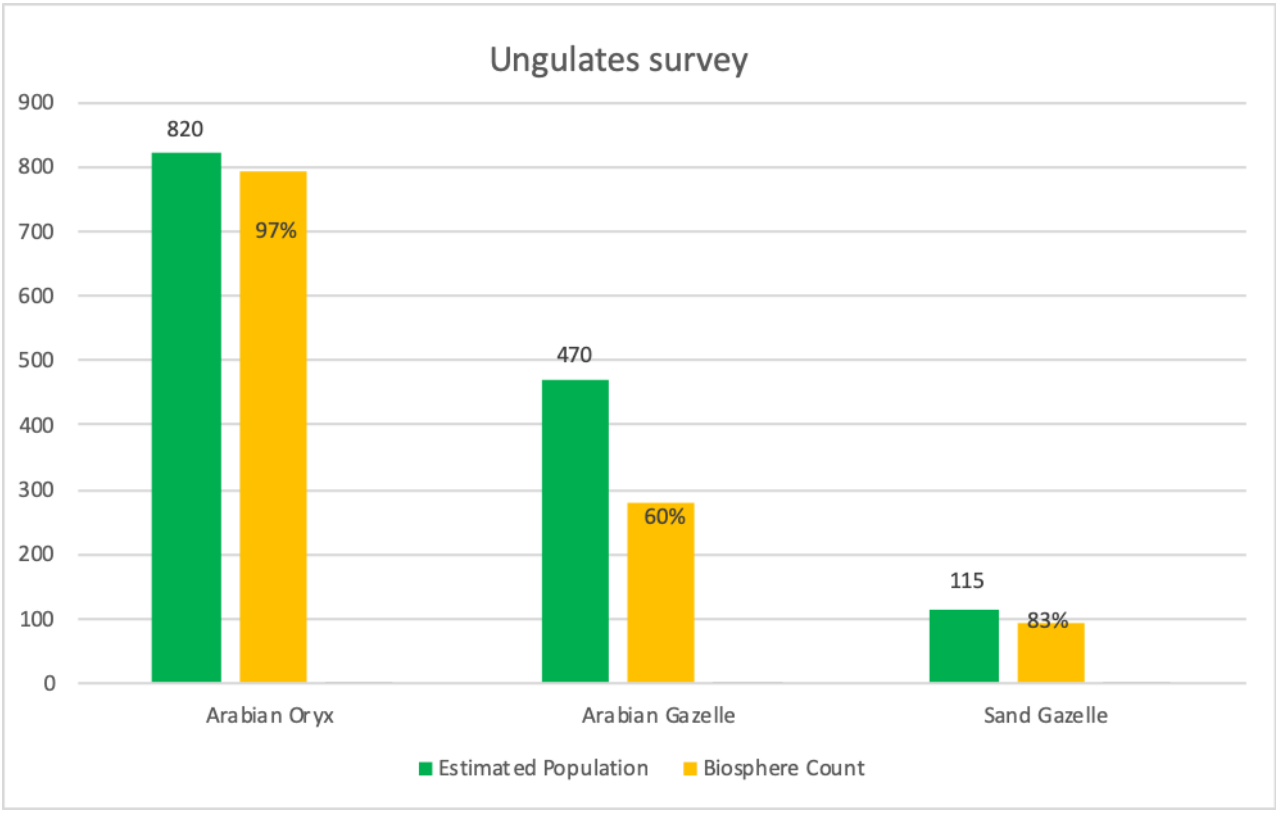


Figure 2.5.2a. Ungulates recorded by the expedition as a percentage of the estimated population.

Arabian oryx

We recorded 792 Arabian oryx, representing 96.6% of the estimated population of approximately 820 Arabian oryx.

The majority of Arabian oryx (599) were counted at 15 of the 16 feeding spots (N6 recorded no oryx) with herd sizes varying from 2 up to 72 individuals, with an average herd size of 40 individuals. A total of 106 Arabian oryx with known group size were recorded during the quadrant survey circular and random observations, 34 solitary and 72 Arabian oryx were recorded in 18 groups (Figure 2.5.2b). The Arabian oryx group size ranged between two and 21 animals.

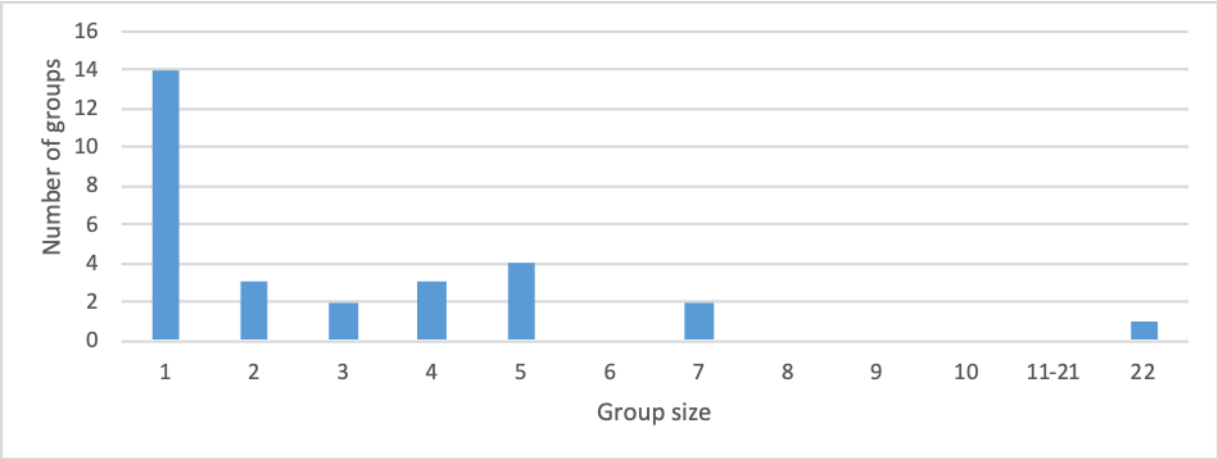


Figure 2.5.2b. Arabian oryx group size as recorded by random and circular observations.

Arabian gazelle

We counted 280 Arabian gazelles, representing 59.6% of the total estimated population of approximately 470 Arabian gazelle as determined by the weekly DDCR staff counts (Figure 2.5.2a). The expedition data yielded a true distribution of Arabian gazelle in the DDCR as only 24 individuals were counted on the feed spots. All the rest were counted during the circular and random observations. From the 45 random observations a total of 110 Arabian gazelles were recorded, 18 were solitary individuals and 92 were recorded in 27 groups for results (Figure 2.5.2c). The group size ranged between 2 and 16. Results from circular observations were not included here as the group sizes for most of the observations were not recorded.

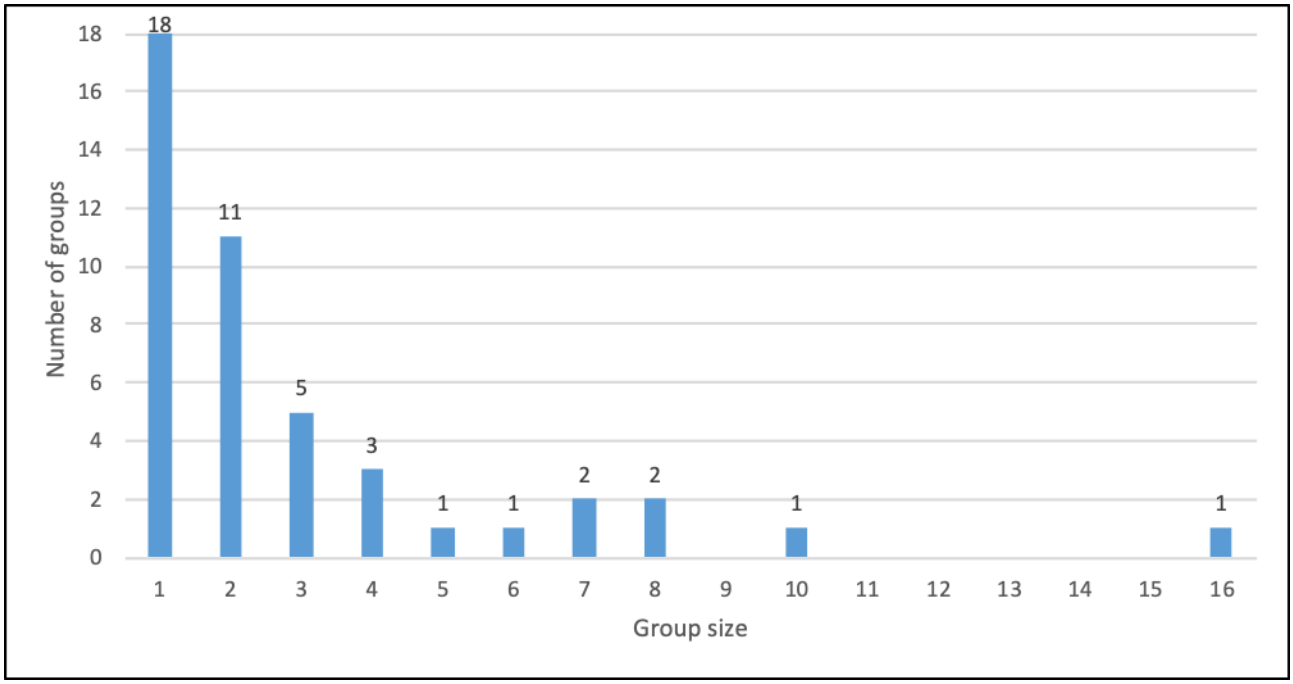


Figure 2.5.2c. Arabian gazelle group size as recorded by random observations.

Sand gazelle

The count of 95 sand gazelle represented 82.6% of the total estimated population of approximately 115 sand gazelles as determined by the weekly DDCR staff counts (Figure

2.5.2a). During species encounter surveys in quadrants we recorded a total of 30 random and circular observations of 14 solitary individuals and a total of 80 individuals in 16 groups (Figure 2.5.2d) with group size ranging between 2 and 22 animals. Due to the favourable vegetation conditions in the DDCR, sand gazelles were mainly grazing on the natural vegetation within the sand dunes. Only one individual was recorded around the feed spots.

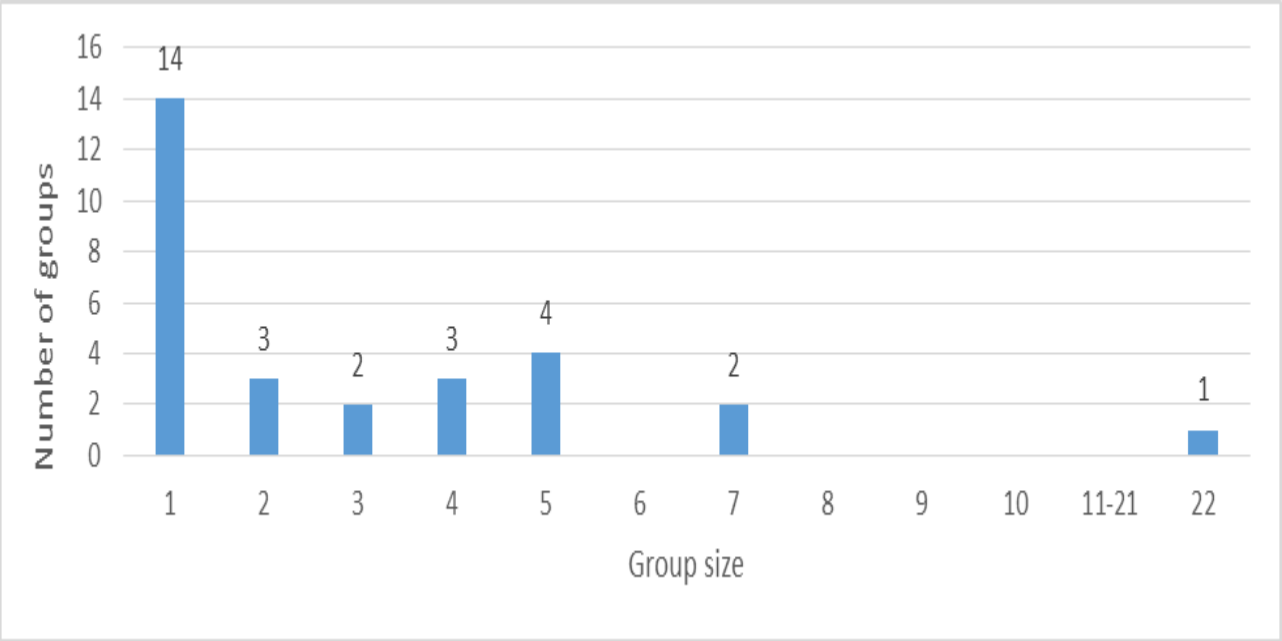


Figure 2.5.2d. Sand gazelle group size as recorded by random and circular observations.

Other target species

Table 2.5.2e shows other target species recorded during quadrant surveys. Methods used were feed spot counts, circular and random observations.

Table 2.5.2e. Other target species recorded by feed spot, circular and random observations.

Species	Total recorded	Circular observations	Feed points	Random encounters
MacQueen's bustard	9	0	1	8
Arabian hare	7	0	0	7
Greater hoopoe-lark	7	3	0	4
Arabian great grey shrike	18	0	0	18

2.5.3. Discussion and conclusions of species encounter surveys in quadrants

Concentrating the species encounter surveys in the quadrants minimised double counting compared to previous expeditions and therefore led to more accurate results for a better understanding of the distribution of all three ungulates species in the DDCR.

Good rainfall in 2019 resulted in improved vegetation condition throughout the DDCR. As such, Arabian gazelles and especially the sand gazelles were observed feeding mainly on the natural vegetation. Also, because of good vegetation availability, 25% of the Arabian oryx population in the DDCR were not recorded at their usual feed spots, in contrast to drought periods when the oryx congregate around feed spots, alongside Arabian and sand gazelles.

The time of day when observations were made at feed points skews the data, with early hours favouring animal presence. For example, on feed spot North-6, 32 Arabian oryx were recorded by the DDCR feed team in the morning and no animals during the same afternoon (Table 2.5.3a). The same pattern emerges for other feed points.

Table 2.5.3a. Feed point counts by the expedition.

Date	Feed point	Quadrant	Arabian oryx	Arabian gazelle	Sand gazelle
19-Jan-20	N1	D9	42	3	0
19-Jan-20	N2	E7	55	5	1
19-Jan-20	N3	F5	9	0	0
19-Jan-20	N4	G2	2	0	0
19-Jan-20	N5	G8	46	4	0
19-Jan-20	N6	I9	0	0	0
19-Jan-20	N7	D8	40	0	0
20-Jan-20	S1	E10	22	1	0
20-Jan-20	S2	H11	38	0	0
20-Jan-20	S3	D11	73	2	0
20-Jan-20	S4	F15	46	0	0
19-Jan-20	S5	I9	24	2	0
20-Jan-20	S6	H11	49	0	0
20-Jan-20	S7	E11	41	2	0
20-Jan-20	S8	G14	68	0	0
20-Jan-20	S9	F11	44	5	0
		Total:	599	24	1

Arabian oryx

Our results show that Arabian oryx were distributed more in the west, central and south of DDCR. This is mainly due to the feed points recently moving towards the west of the DDCR near the ungulate enclosures that are being constructed there to capture and hold the surplus Arabian oryx from the reserve. The predicted distribution of Arabian oryx across the DDCR is highly concentrated around the feed points (Figure 2.5.3a), where food is easily found. Farms in DDCR were clearly not the attraction points for Arabian oryx, except Manana farm in the south of the reserve next to the big lake due to the water source and favourable vegetation species composition (*Dipterygium glaucum* and *Limeum arabicum)*.

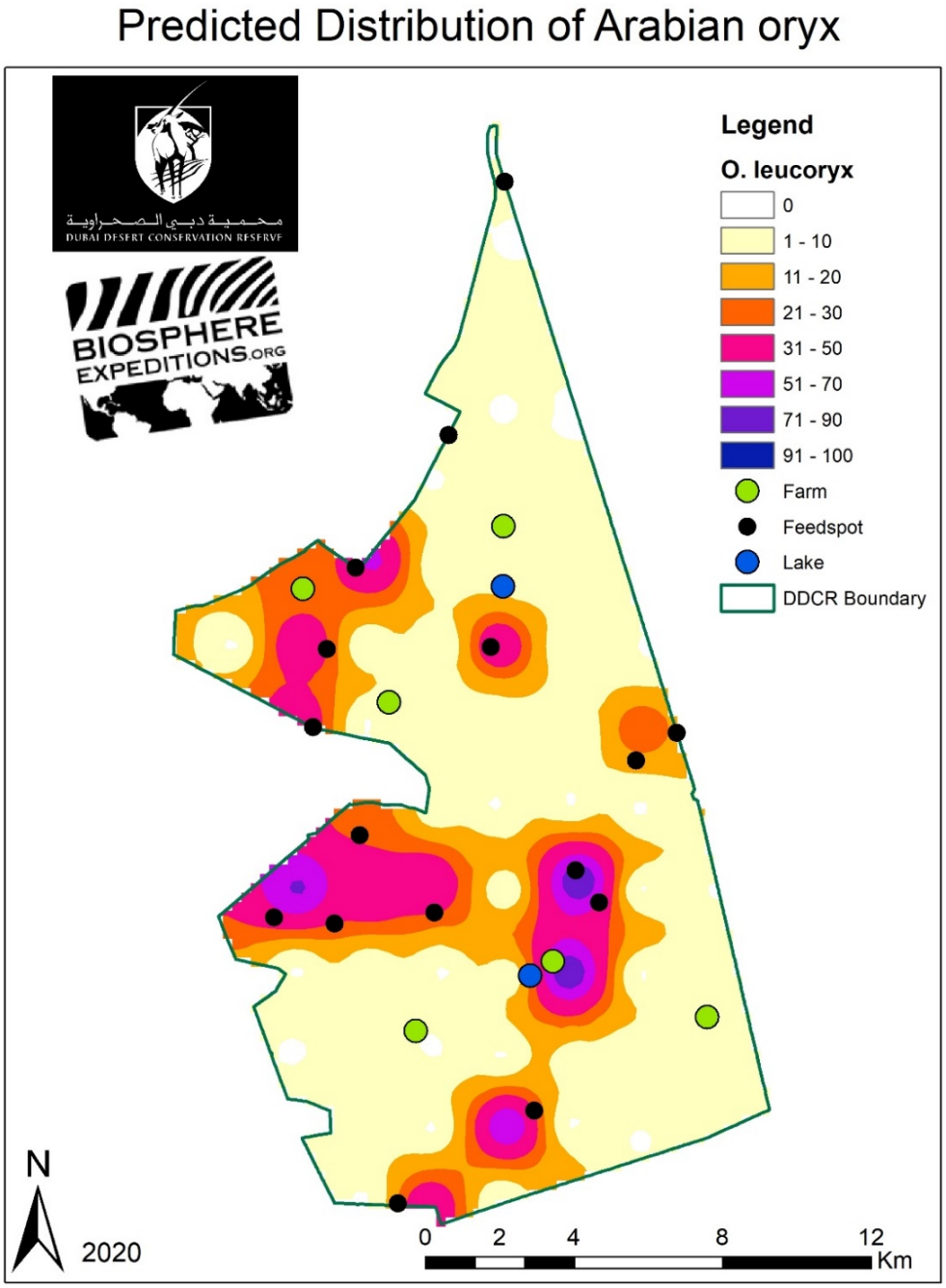


Figure 2.5.3a. Arabian oryx distribution 2020. Predicted distribution calculations are based on a combination of feed spot counts, random and circular observations data.

Arabian gazelle

The main concentration of Arabian gazelle was in the central and central-south parts of the DDCR, mainly around the irrigated areas at the old farms and tree plantations, which provide more food for the species (Figure 2.5.3b). Only 24 Arabian gazelles were recorded around the feed points, mainly near the east Ghaf forest, a small lake and tree plantation. The other 254 individuals were recorded in irrigated areas and some on gravel plains.

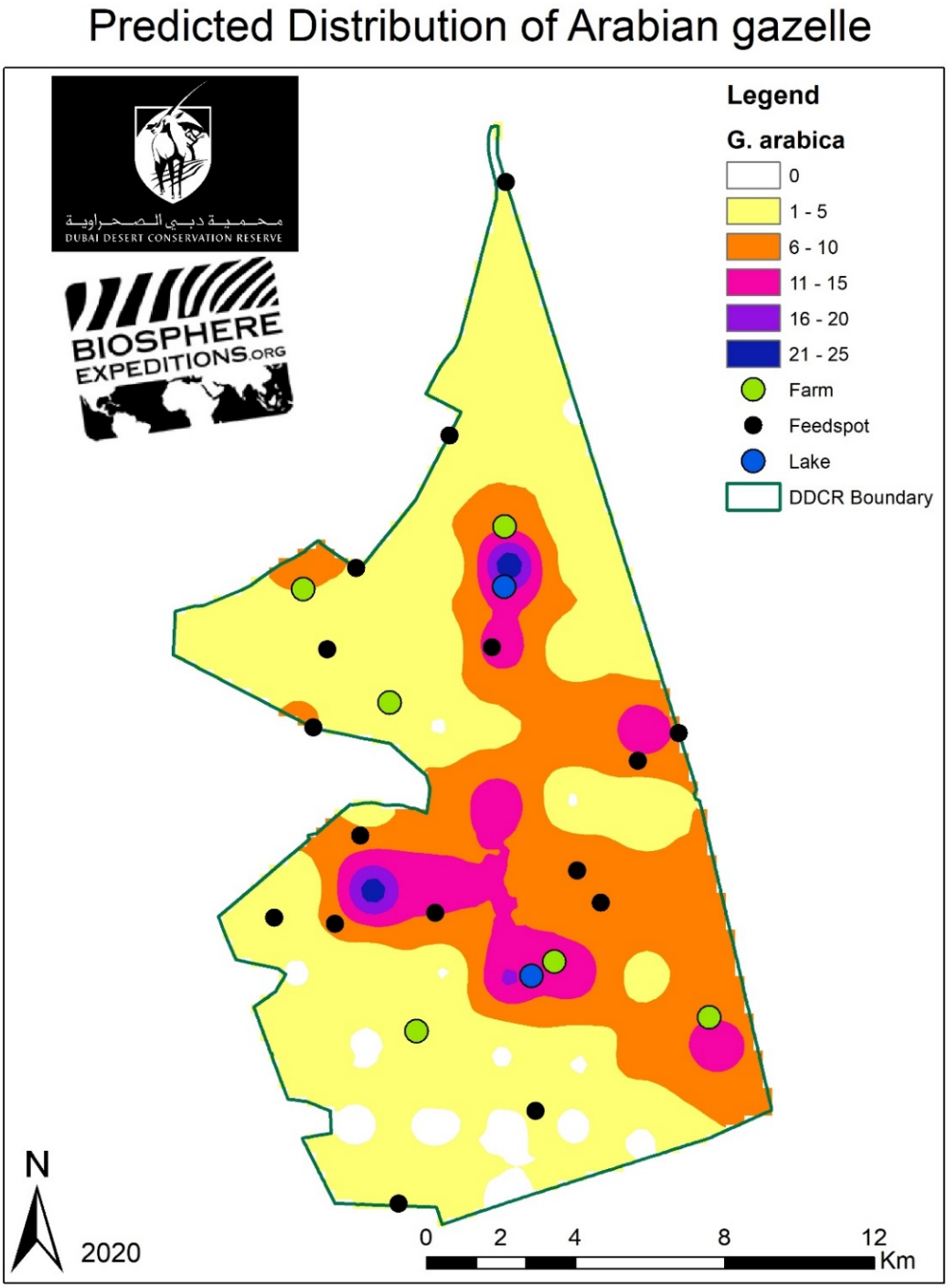


Figure 2.5.3b. Arabian gazelle distribution 2020. Predicted distribution calculations are based on a combination of feed point counts, random and circular observations data.

Sand gazelle

It is always a challenge to count the sand gazelle in its preferred sand dunes habitat, but through the expedition it was possible to gain a better understanding of sand gazelle distribution. Sand gazelles were mainly observed in sand dunes, as well as around the irrigated areas (Figure 2.5.3c), where there is more food to be found. The largest group of 22 sand gazelles was recorded at Ghadeer farm in the DDCR's central north of DDCR (Figure 2.5.3c). Feed points were of no interest to the species in 2020, with only one individual recorded. The remaining 104 individuals were recorded in the irrigated areas and dunes in the south. Successful breeding of sand gazelles as evidenced by new-born fawns was also recorded.

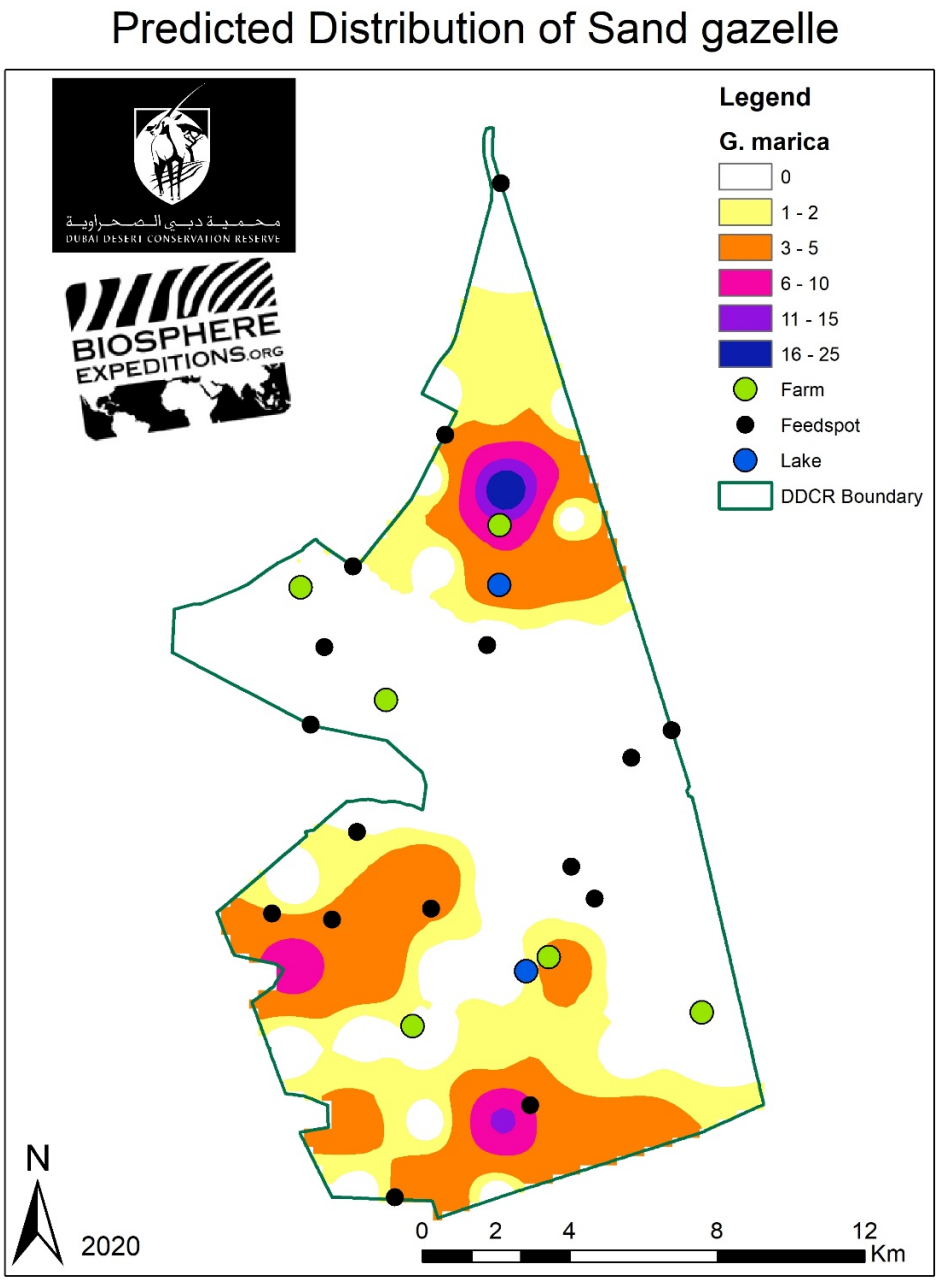


Figure 2.5.3c. Sand gazelle distribution 2020. Predicted distribution calculations are based on a combination of feed point counts, random and circular observations data.

MacQueen's bustard

A total of nine MacQueen's bustards were recorded, mostly distributed in the central part of the DDCR at Ghadeer farm. One individual was recorded in the central-west near the camel farm (see Figure 2.5.3d).

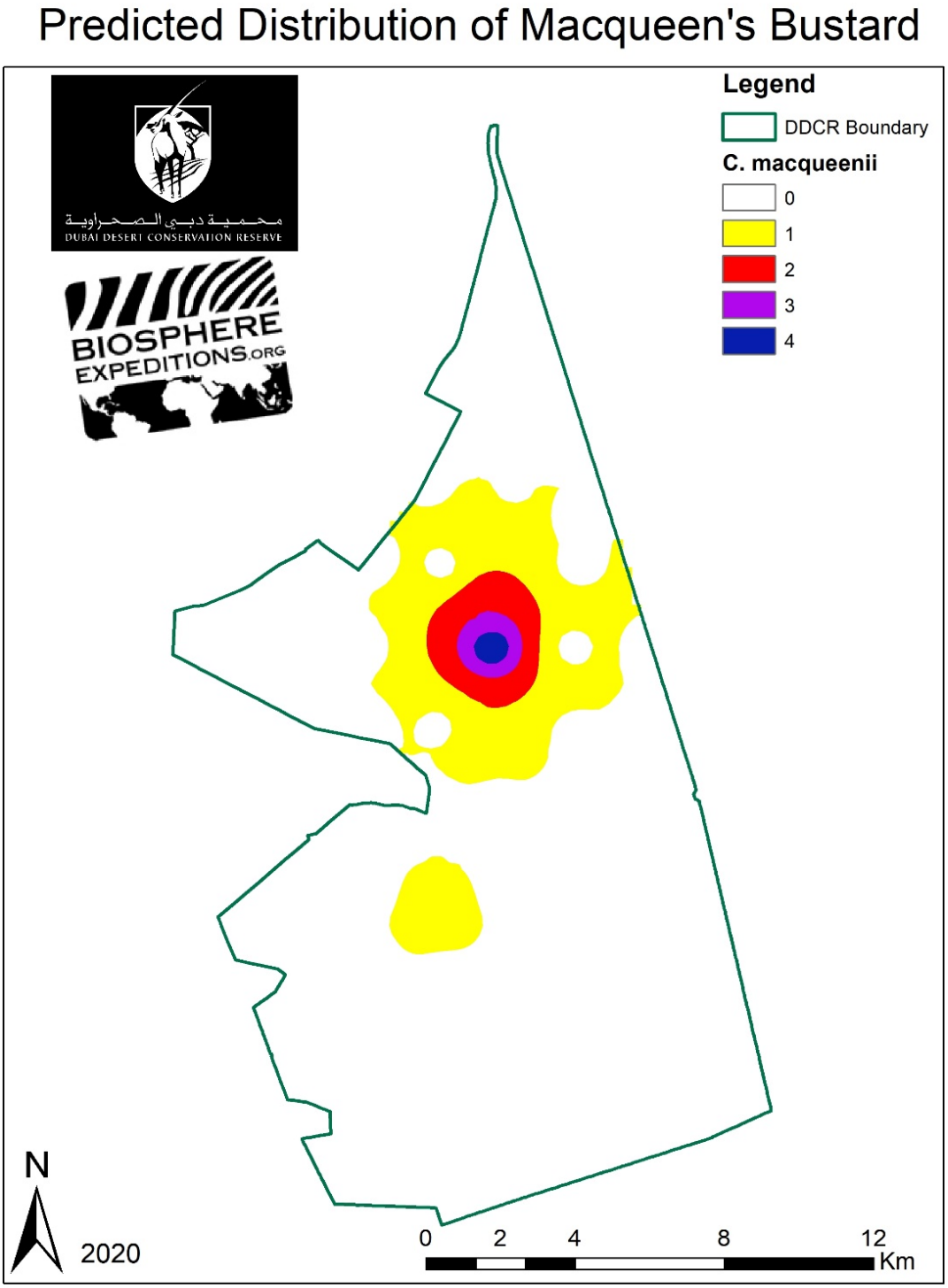


Figure 2.5.3d MacQueen's bustards distribution 2020. Predicted distribution calculations are based on a combination of feed point counts, camera trap records, random and circular observations data.

Arabian hare

After good rains during 2019, Arabian hares were again observed in the reserve after an absence of three years, including seven records by the expedition. We believe their reappearance is largely due to the now once again favourable vegetation conditions in the DDCR. Arabian hares were mainly observed in the south and central parts of DDCR in sand dunes with vegetation dominated by fire bush (Figure 2.5.3e).

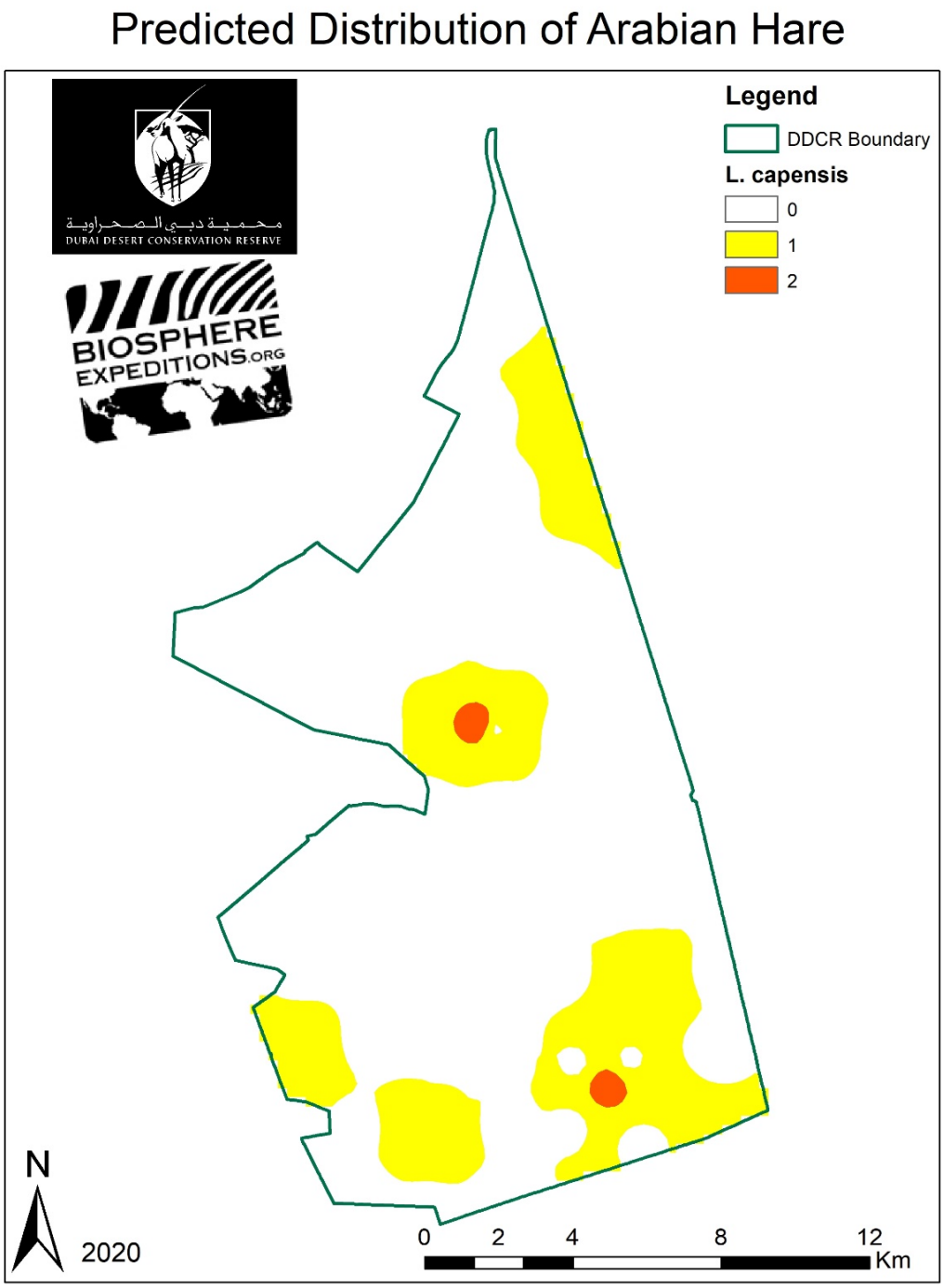


Figure 2.5.3e. Arabian hare distribution 2020. Predicted distribution calculations are based on a combination of camera trap records, random and circular observations data.

Greater hoopoe-lark

A total of seven greater hoopoe-larks were observed during the circular and random observations. All observations were recorded from the south of the reserve (Figure 2.5.3f), mainly due to the team's effort and identification skills in that area.

Figure 2.5.3f. Greater hoopoe-larks distribution 2020. Predicted distribution calculations are based on a combination of random and circular observations.

Arabian great grey shrike

A total of 18 Arabian great grey shrikes were observed during the circular and random observations. Most observations were recorded in the south of the reserve, but some also in the central north (Figure 2.5.3g) mainly due to the team's effort and identification skills in that area.

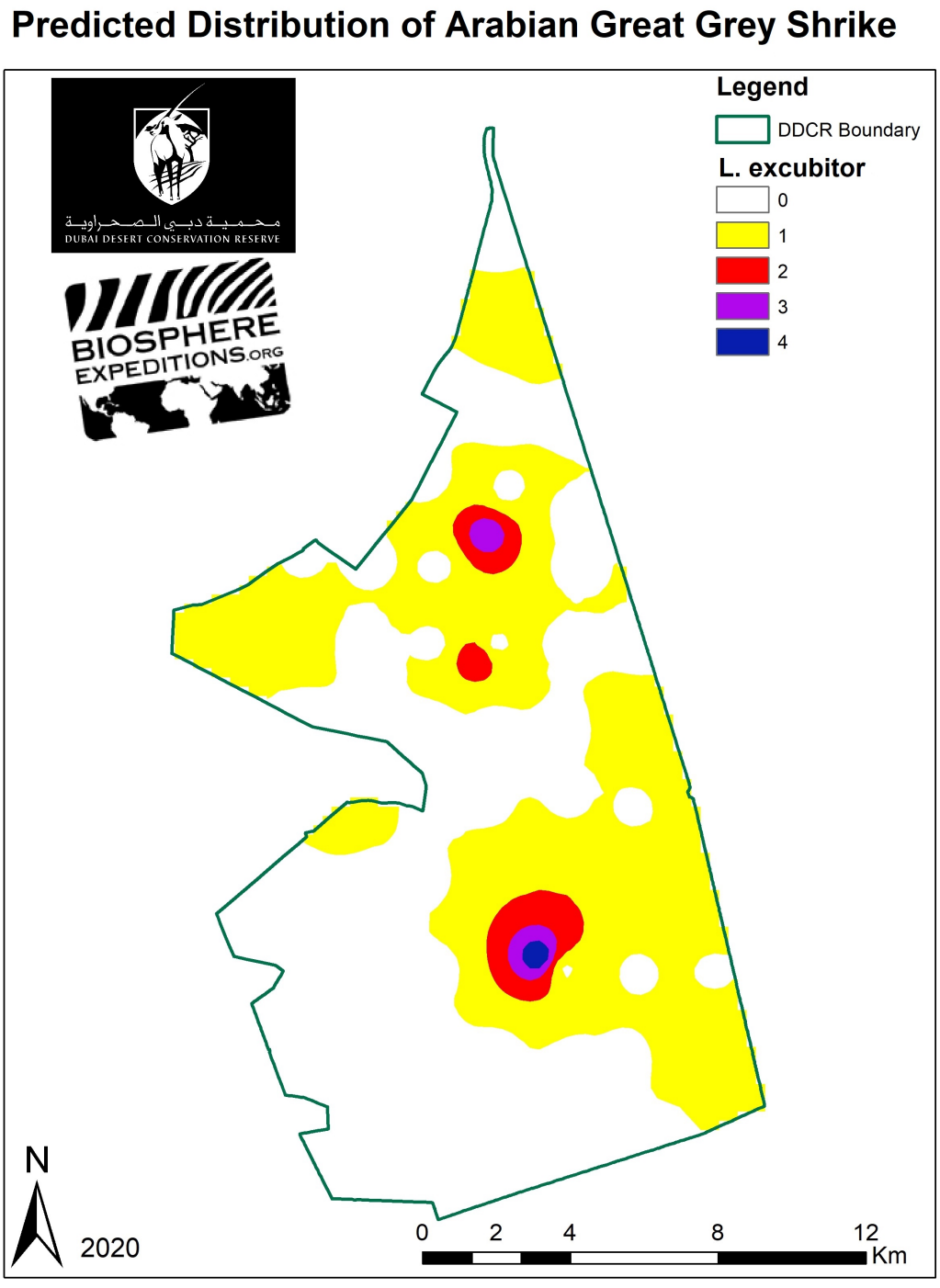


Figure 2.5.3g. Arabian great grey shrike distribution 2020. Predicted distribution calculations are based on a combination of random and circular observations.

2.6. Live-trapping of medium-sized animals

2.6.1. Methods for live-trapping of medium-sized animals

Nine Tomahawk live traps were set during the expedition with the aim of capturing Arabian wildcat, sand fox and Arabian red fox to elucidate their current population status in the DDCR and to collect morphological data from captured individuals. At the beginning of the expedition, three survey groups were given nine live traps to be placed within their allocated zones (North, South and Central Zones). Selection of the live trapping location was based on recent meso-carnivore records by DDCR staff, including animal sightings and camera trap records, as well as active dens recorded. Each group marked the position of the live trap on a handheld GPS. The live traps were baited with tinned sardines and left out in the field for four nights, resulting in a total of 36 trap nights. The bait was placed at the very back of the trap (using an extendable reacher/grabber), forcing the animal to step onto a pressure plate, triggering the trap, to reach the bait (Figure 2.6.1). The pressure plate was covered with sand to give the trap a more natural appearance and to ensure that the target species would be more at ease when entering the trap.

Figure 2.6.1. Setting a live trap.

Each morning the groups checked all live traps within their allocated zone. This involved firstly checking the traps for any captured animals and then inspecting the surroundings for any indication of the presence of Arabian wildcat, feral cat or other meso-carnivores from tracks around the trap, or if the trap had been disturbed or investigated by an animal. Where necessary, traps were rebaited; all traps were also rebaited before the third trapping night.

Trapped target species were sedated by reserve staff and then sexed, weighed, measured and fitted with a numbered ear tag. Each individual was aged as either an adult or a sub-adult based on the degree of canine and molar development. Specific external body measurements taken included total length, tail length, hind foot length, ear length and shoulder height. Once the individual had recovered from sedation it was released at the point of capture.

2.6.2. Results of live-trapping of medium-sized animals

Nine traps were set for four nights for a total 36 trapping nights. Only one feral cat (Figure 2.6.2) was captured in the north, near Nazwa Mountain. Although tracks of red fox were found around two traps, no individuals were captured. Two of the traps in the south (LT-S2) were triggered with no capture, probably due to strong winds as no fox or cat tracks were seen.

Figure 2.6.2. Feral cat captured near Nazwa Mountain.

2.6.3. Discussion and conclusions for live-trapping of medium-sized animals

Over a total of 36 trapping nights, only one feral cat and no native meso-carnivore species were captured. Compared to previous years, we increased the number of traps from three to nine live traps. We believe one contributor to this low success rate to be the rains and therefore higher prey base availability, which means predators were not attracted to the traps. However, the trapping success rate over the last eight years has been extremely low overall (Table 2.6.3). A larger trapping effort through increasing the number of traps will be made during future Biosphere Expeditions surveys in an attempt to capture the target species of Arabian wildcat, sand fox and red fox.

Table 2.6.3. Results of meso-carnivore live trapping sessions between 2012 and 2020.

		2012	2013	2014	2015	2016	2017	2018	2019	2020
Total trapping effort (trap nights)		48	48	53	60	72	20	15	27	36
Triggered with target species		0	1	1	0	0	0	2	0	0
Unsuccessful trigger		0	0	0	1	0	0	1	1	0
Triggered by non-target species		1	1	0	2	1	0	1	0	1
Meso-carnivore species captured	Feral cat	1	0	0	1	0	0	1	0	1
	Wildcat	0	1	0	0	0	0	0	0	0
	Sand fox	0	0	1	0	0	0	0	0	0
	Red fox	0	0	0	0	0	0	2	0	0

2.7. Arabian red fox den surveys

2.7.1. Methods for Arabian red fox den surveys

The Arabian red fox is the largest predator within the DDCR, so it is vital 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 counting their dens. A survey of the reserve was done by DDCR staff in 2011 to identify as many dens as possible and then from 2016 to 2019, with the help of Biosphere Expeditions, the previously identified dens were monitored. Any new incidental discoveries of new dens were included; 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 2020 expedition, all active and inactive den 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. All abandoned dens from 2019 were not revisited. 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.

Figure 2.7.1. Recording a den site.

2.7.2. Results of Arabian red fox den surveys

68 dens were surveyed, of which 45 had previously been classified as active or inactive during the 2019 expedition, with an additional 23 newly identified dens (Figure 2.7.2a). Six dens were classified as active, 30 inactive and 32 abandoned.

Apart from the 23 new dens identified in the 2020 expedition, one possible sand fox den was also identified.

2.7.3. Discussion and conclusions for Arabian red fox den surveys

The 2020 red fox den surveys show a decrease in the number of surveyed or identified active and inactive dens compared to 2019 (Table 2.7.3a). 69% of the dens previously classified as active and inactive in 2019 were found abandoned by the 2020 expedition. Only 23 new den sites (2 active and 21 inactive) were found during the 2020 expedition, compared to 30 new den sites during the 2019 expedition (Table 2.7.3a and Figure 2.7.3a). Dens recorded as abandoned during previous years were not included in the 2020 survey. From all the previous surveys, starting from 2011 (the first survey was without Biosphere Expeditions) and between 2016 and 2020 (annual Biosphere Expeditions surveys), a total of 283 red fox den sites were recorded and classified.

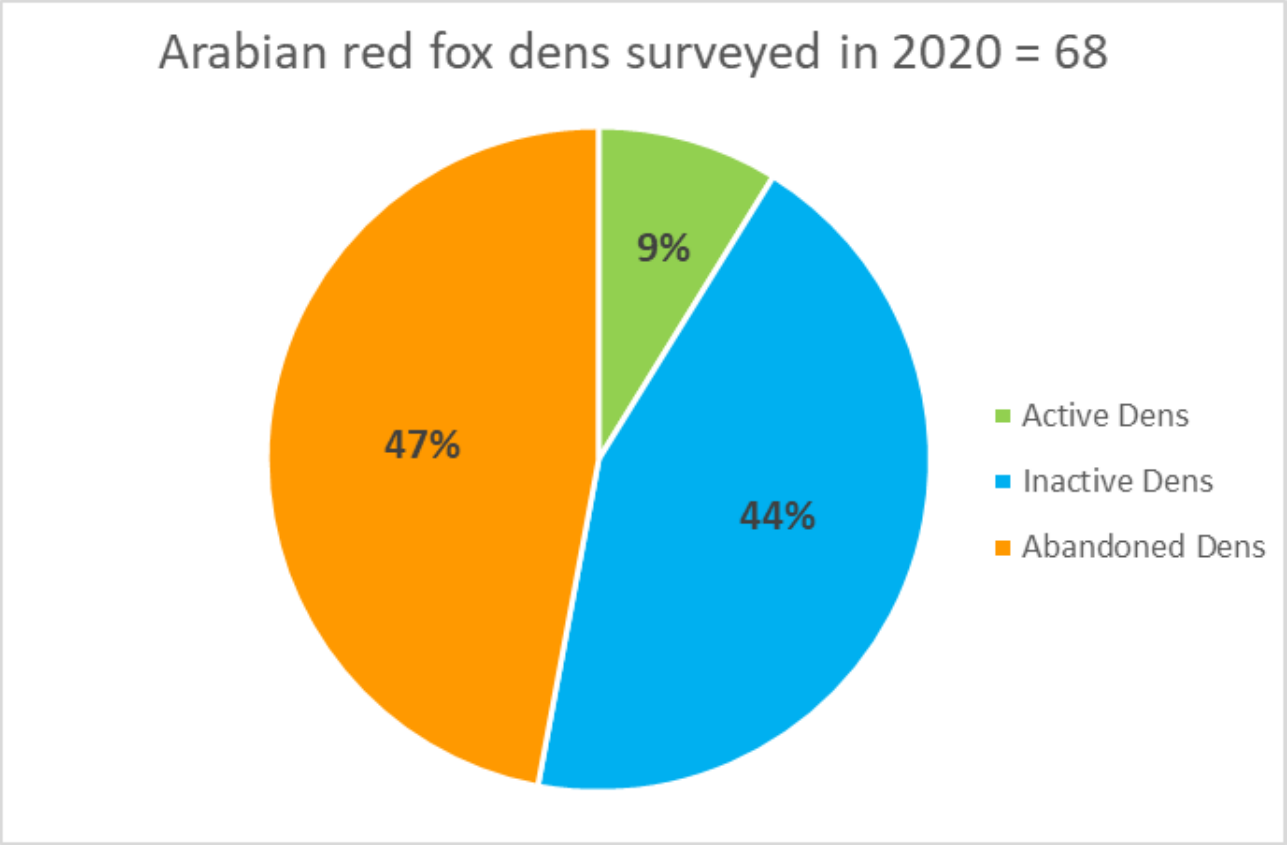


Figure 2.7.2a. Classification of Arabian red fox dens survey results from the 2020 expedition.

Table 2.7.3a. Results of the Arabian red fox den surveys in 2011 and 2016-2020.

Status	2011	2016	2017	2018	2019*	2020*
Active	66	59	24	11	15	6
Inactive	95	52	40	42	29	30
Abandoned	0	57	138	167	49	32
TOTAL	161	168	202	220	93	68
Status changes						
Unchanged		55	65	138	62	6
New Active		4	14	7	11	2
Inactive to Active		25	2	2	1	2
New Inactive		3	24	8	19	21
Active to Inactive		24	3	10	2	5
Active to Abandoned		12	43	17	6	8
Inactive to Abandoned		45	39	25	35	24
Not Surveyed		0	11	10	0*	0*

* Previously abandoned dens were not surveyed

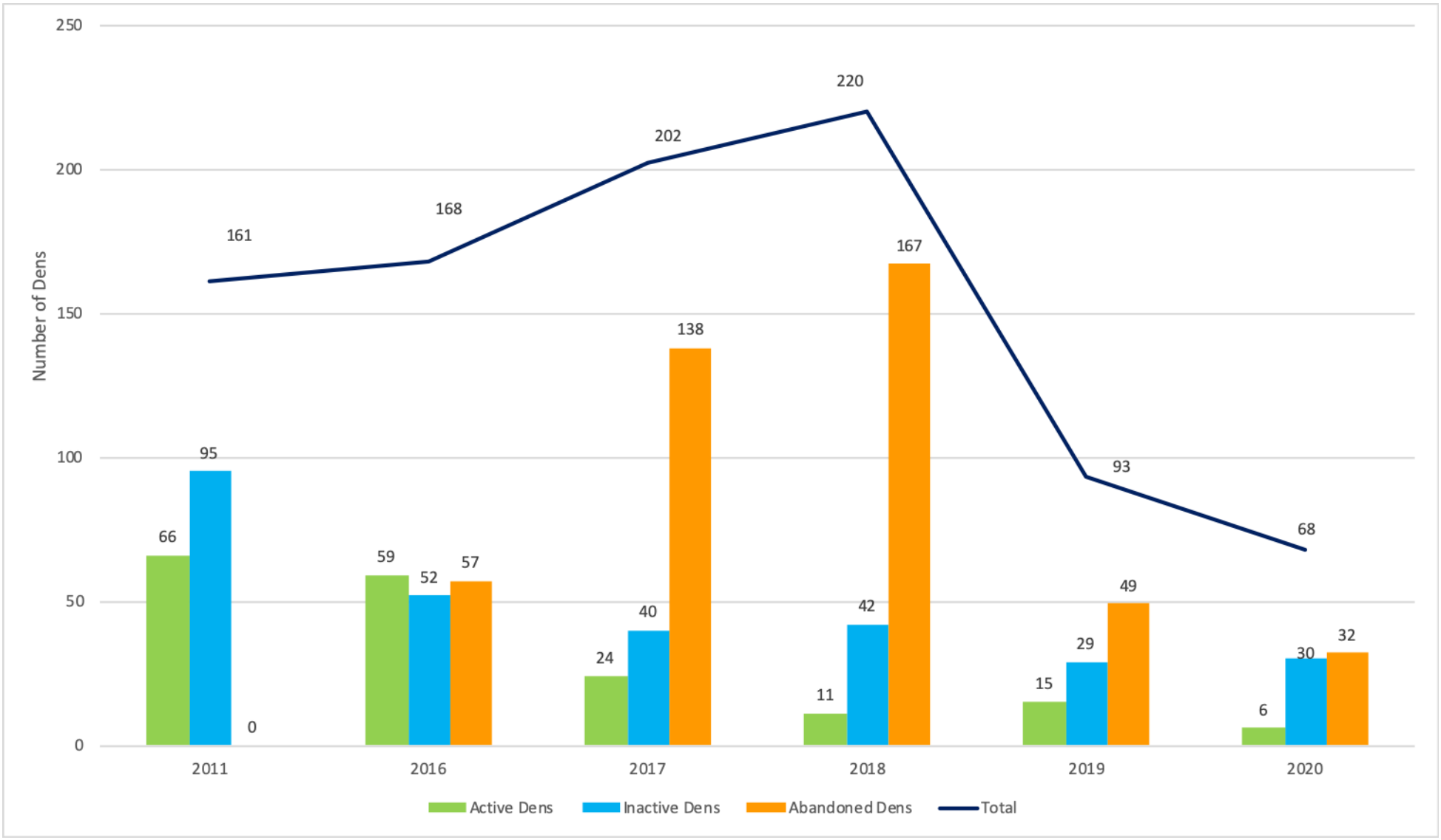


Figure 2.7.3a. Results of the Arabian red fox den surveys in 2011 and 2016-2020.

The well-vegetated sites recorded the highest den densities for both active and inactive dens. These sites were dominated by tall shrubs, in particular *Leptadenia pyrotechnica,* which meet the habitat requirements of providing a stable soil substrate supported by the shrub's root system. Also, a few dens were recorded in rocky areas on Nazwa Mountain.

With the Kernel density analysis, the concentration of active and inactive dens can be seen mostly in the south and central parts of the DDCR (Figure 2.7.3b). Also, a few active dens were recorded in the north of the DDCR, but as more abandoned dens were also recorded in the north, this could be partly due to the disturbance level from the construction work going on in the north.

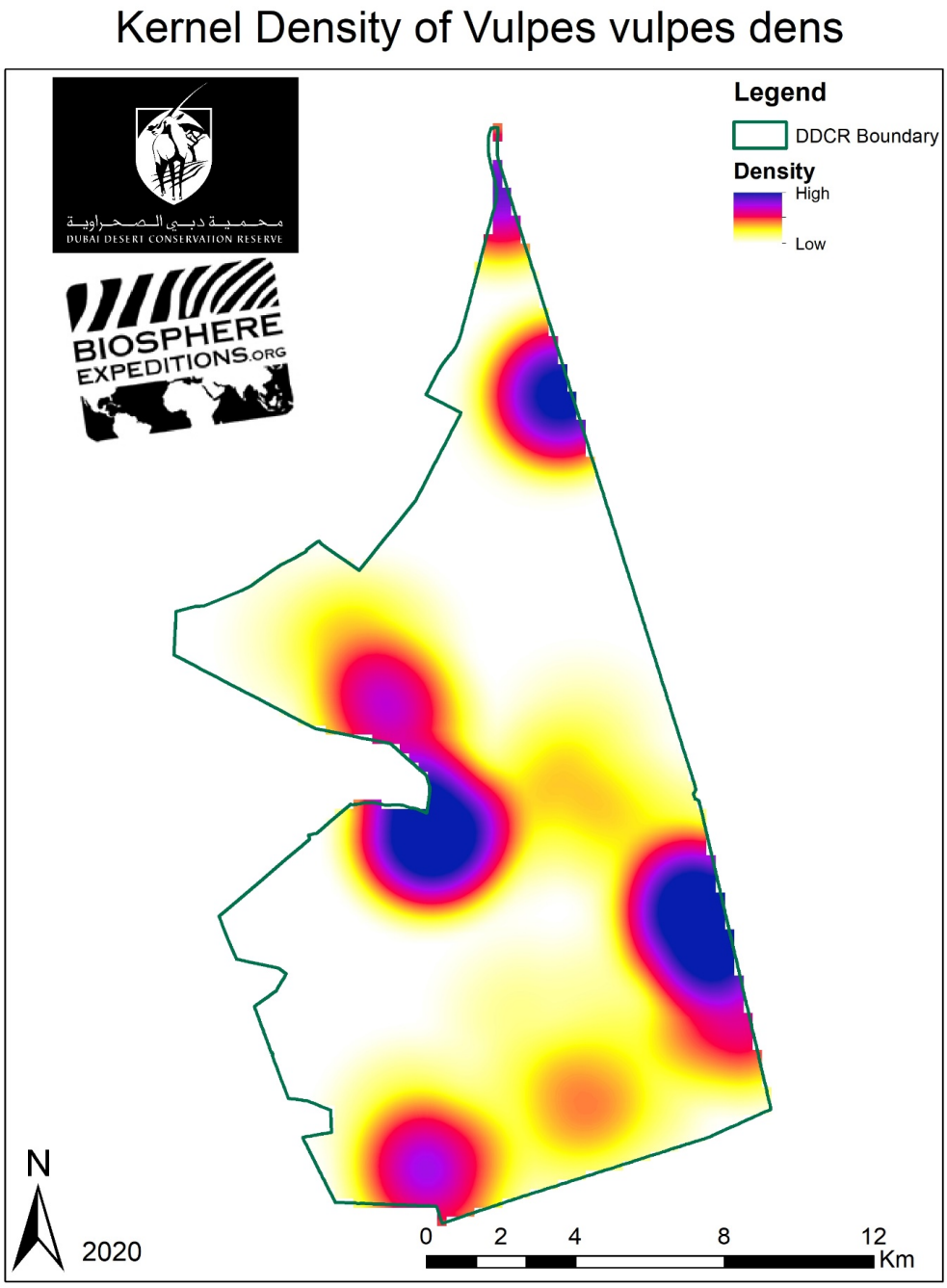


Figure 2.7.3b. Arabian red fox den distribution in 2020.

Comparing the results of this monitoring programme over the past years shows that most den sites were surveyed and discovered between 2016 and 2018 (Figure 2.7.3a), with a sharp drop in 2019 and 2020. This variability is not connected to observer numbers, as some high discovery years actually had fewer observers. Instead we believe that den discovery and correct classification is a difficult task for citizen scientists. Also, one of the main reason for changing the status of dens from active and inactive to abandoned this year may well have been the heavy rains recorded during early January 2020, which may have caused many dens to collapse. Red foxes occupying those dens may have made new dens at new sites, undiscovered by the expedition.

There were several sightings recorded by DDCR staff of red foxes between December 2019 and January 2020. At least 20 active dens were discovered after the 2020 expedition between February and March 2020. Also, red foxes were recorded on four camera traps during the 2020 expedition. Finally, due to the favourable vegetation conditions after the rains, the red fox prey base is likely to have improved in the reserve. All these are positive indicators for the status of the fox population inside the DDCR, even though the den surveys might suggest otherwise.

2.8. Small mammals trapping

2.8.1. Methods for small mammals trapping

The number of ungulates in the DDCR has increased significantly over the last five years, which has caused grazing pressure on the vegetation growth. As small mammals are known to be good indicators of ecosystem health, a trapping survey was conducted to elucidate the population status of small mammals at the trapping sites.

Figure 2.8.1a. Setting up a small mammal trap in a sandy area.

Six rodents trapping sites (grids) were selected in three different habitat types within the DDCR: Three sites were selected on sand dunes (sandy areas), two on gravel plains and one on the rocky outcrop near Nazwa in the north of the reserve. Both trapping sites on gravel plains (RS1 & RS2) and one trapping site in a sandy area (RS6) were moved from previous locations as no small mammals were captured on these locations during the 2019 expedition. All trapping sites were between 100 m and 300 m from the main driving tracks in the Reserve, to be easily accessible for setting and especially for checking in the morning. All trapping sites (grids) were set for four nights. Each trapping grid consisted of 10 small mammal Sherman traps. Traps were set (Figure 2.8.1a) and baited with oats before sunset and checked early the next morning. Captured animals were identified, and pictures were taken of each captured individual for further identification. Species, sex, age and general body condition of each captured rodent were recorded and the animal was then released at the point of capture. Traps were closed every morning and set again before sunset. The 2020 expedition team was also trained to collect faecal samples from captured small mammals. These samples were collected for a collaboration project with New York University, Abu Dhabi to study the food content and for collecting genetic samples of small mammals in the DDCR.

Citizen scientists were asked to mark captured individuals to estimate the population size of each rodent species captured using Mark Release Recapture (MRR) methods, but many found it difficult to handle live animals (Figure 2.8.1b) and so marking captured small mammals was not possible during the first two days as planned.

Figure 2.8.1b. Handling live animals.

2.8.2. Results of small mammal trapping

239 trapping nights over six grids resulted in a total of 31 capture-recaptures, which included two species: 28 Cheeseman's gerbils (20 males, 8 females) and 3 Baluchistan gerbils *Gerbillus nanus* (2 males, 1 female) (Table 2.8.2a).

In addition, two non-target species were captured in the rocky area (RS-5): three house sparrows and one white-eared bulbul.

The total trapping success rate was 12.97%. 31 traps were triggered without capture, representing a 12.97% trapping failure rate (false trigger) (Table 2.8.2a). Some traps triggered in RS5 and RS6 without capture were due to oryx moving the traps or bird interference.

Small mammals were captured in all six girds. The largest number of successful captures was recorded in RS3 grid, where eight Cheeseman's gerbils were captured (Table 2.8.2a). The next highest number was recorded in RS4 grid, with seven of the same species captured. Both sites were among the sandy dune habitat (Table 2.8.2a). In gravel area RS2, five Cheeseman's gerbils and one Baluchistan gerbil were captured. In gravel area RS1, two Cheeseman's gerbils and one Baluchistan gerbil were captured. In the rocky area RS5, one Baluchistan gerbil was captured.

Table 2.8.2a. Results of small mammal trapping.

Trapping area	Habitat	Trap nights	Individuals captured-recaptured	Success rate %	No. trap failure	Trap failure rate %	Species captured
RS1	Gravel	40	3	7.5	3	7.5	Cheeseman's gerbil Baluchistan gerbil
RS2	Gravel	40	6	15	0	0	Cheeseman's gerbil Baluchistan gerbil
RS3	Sand	40	8	20	3	7.5	Cheeseman's gerbil
RS4	Sand	40	7	17.5	2	5	Cheeseman's gerbil
RS5	Rocky	40	1	2.5	9	22.5	Baluchistan gerbil House sparrow White-eared bulbul
RS6	Sandy	39	6	15.38	14	35	Cheeseman's gerbil

2.8.3. Discussion and conclusions for small mammals trapping

Small mammals were captured in all six sampled grids. Small mammal trapping resulted in the total capture of 31 individuals from two species; namely Cheeseman's gerbil and Baluchistan gerbil. No Arabian spiny mouse, Arabian jird or Sandevall's jird were captured, although some of these species were captured in previous studies in the DDCR (Bell & Khafaga 2015). Jird species were recorded by random sightings in the south of the DDCR by the expedition. Rocky areas are the preferred habitat for Arabian spiny mouse, so their occurrence is limited to the relatively small Nazwa outcrop (RS5). Although none were captured this year, the 2019 expedition captured three Arabian spiny mice. The capture of the jird species in DDCR is probably limited by the size of the small mammal traps used, and larger cage traps are needed to improve capture success (Strauss et al. 2008). The general population status of small mammals (with a total trapping success rate of 13%) seems to have improved compared to the previous year. This is likely to be due to the good vegetation condition after the rain event. However, since we moved three trapping grids this year and the sample size was small, this conclusion can be tentative only.

2.9. Camera trapping

2.9.1. Methods for camera trapping

As many species in the desert environment are both nocturnal and elusive, it is difficult to gather reliable information on their populations. Camera traps can be used to study such cryptic species and have the advantage of detecting with equal efficiency both nocturnal and diurnal activities with minimal environmental disturbance.

Sixteen camera traps (three Reconyx RC60, three Reconyx Hyperfire, two Reconyx Hyperfire-2 and eight Bushnell Trophy Cam HD) were used during the expedition and distributed across the DDCR's four designated zones. Predetermined locations in each of the zones were chosen for the survey groups to set their camera traps.

Figure 2.9.1. Setting up a camera trap.

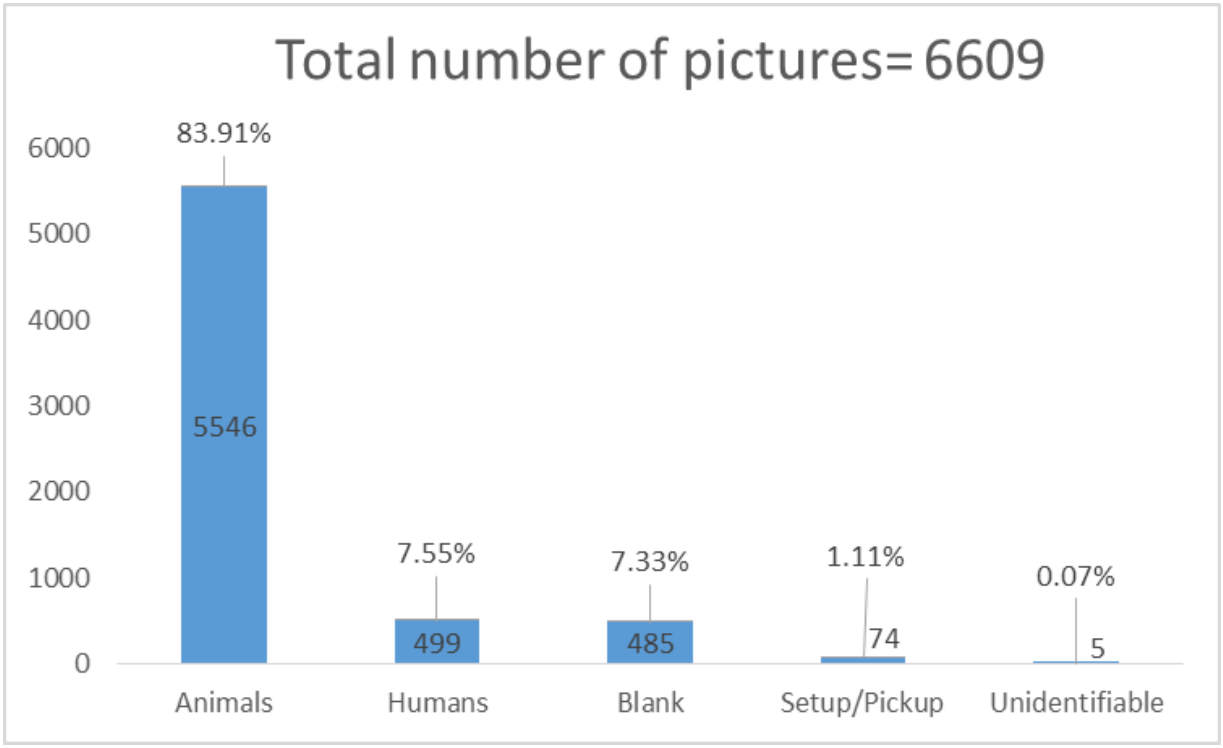
Camera traps were not baited (as this tends to attract red foxes, probably resulting in Arabian wildcats avoiding the sites) and left out in the field for five days, resulting in 80 trap days in total. All camera traps were set to capture three pictures with each trigger at a 10 second interval so that there are more chances of recording or capturing the cryptic species. During the 2018 and 2019 expeditions, all 17 camera traps were set close to water sources. However, as part of an ongoing long-term study for the DDCR, during the summer of 2019 camera traps were set on six other natural sites and these sites are now included in the Biosphere Expeditions survey. Therefore, ten camera traps were set close to water sources, and six were set on other sites.

2.9.2. Results of camera trapping

Eighty camera trapping days captured 6,609 images, 6,119 with recognisable subjects of which 5,546 were of native fauna, as well as 499 of humans or vehicles (Figure 2.9.2a). Twelve wildlife species could be identified from the trapping effort. Two of the 16 traps set, camera trap 5 (natural site) and camera trap 20 (water source), malfunctioned and images recorded by these camera traps were disregarded.

Six mammal species were recorded (Table 2.9.2a). Arabian oryx was the most abundant and widespread species with 4,831 pictures (images) from 11 camera traps. 306 Arabian gazelles images were recorded on eight traps, 133 sand gazelles images on six traps, 22 Arabian red fox images on four traps (Figure 2.9.2c) and also 12 images of the same Arabian wildcat (single individual) by camera trap 11 (Figure 2.9.2d). Arabian hare was recorded by camera trap 14 with 21 images captured and at least two individuals recorded on one image (Figure 2.9.2e).

Only six bird species were recorded this year. (Table 2.9.2a). Two images of a single MacQueen's bustard were recorded (Figure 2.9.2b), as well as large numbers of Eurasian collared doves (607) at five different camera trap locations, 94% of them by camera trap 19. Other bird species recorded and identified from the photos include an individual brown-necked raven, grey francolin, rock doves and laughing doves (Table 2.9.2a).



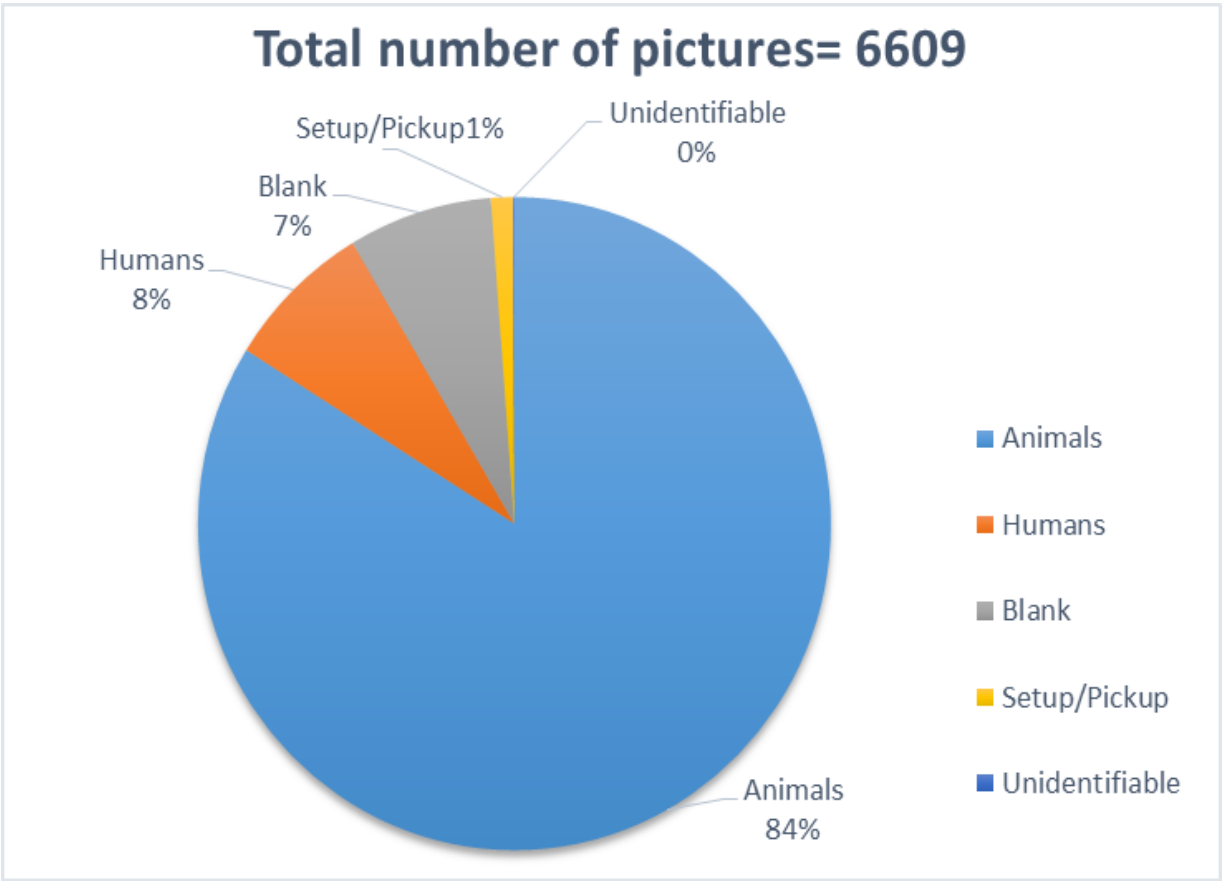


Figure 2.9.2a. Camera trapping results as graphs.

Table 2.9.2a. Camera trapping results by number of animals.

Trap number	Latitude	Longitude	Trap site description	Arabian oryx	Arabian gazelle	Sand gazelle	Arabian red fox	Arabian wildcat	Euras. collared dove	MacQueen's bustard	Rock dove	Arabian hare	Laughing dove	Grey francolin	Brown-necked raven
Trap 02	55.655953	24.904303	Natural (Other)	1	0	0	0	0	0	0	0	0	0	0	0
Trap 03	55.660494	24.869189	Water source	400	21	0	0	0	18	2	0	0	8	5	0
Trap 04	55.665463	24.900862	Water source	24	55	3	0	0	10	0	0	0	0	0	0
Trap 05	55.662121	24.982317	Natural (Other)	malfunction											
Trap 06	55.65594	24.850245	Natural (Other)	0	0	0	0	0	0	0	0	0	0	0	0
Trap 07	55.647524	24.766422	Water source	1617	3	6	6	0	3	0	15	0	0	0	3
Trap 08	55.662777	24.980824	Water source	716	0	0	1	0	0	0	2	0	0	0	0
Trap 09	55.677639	24.870299	Water source	2	0	0	0	0	0	0	0	0	0	0	0
Trap 11	55.656984	24.74116	Water source	1201	9	12	0	12	6	0	0	0	0	0	0
Trap 12	55.626555	24.819682	Natural (Other)	0	6	0	0	0	0	0	0	0	0	0	0
Trap 13	55.616534	24.779901	Natural (Other)	19	0	0	0	0	0	0	0	0	0	0	0
Trap 14	55.693987	24.762744	Natural (Other)	0	0	0	0	0	0	0	0	24	0	0	0
Trap 15	55.613695	24.885371	Water source	547	15	9	0	0	0	0	0	0	0	0	0
Trap 17	55.703251	24.820728	Water source	2122	96	6	3	9	0	0	0	0	0	0	0
Trap 19	55.613408	24.795528	Water source	6595	233	131	12	0	570	0	6	0	0	0	0
Trap 20	55.699843	24.841635	Water source	malfunction											
			Total	13244	438	167	22	21	607	2	23	24	8	5	3

Figure 2.9.2b. A single MacQueen's bustard was captured at a water point by camera trap 3.

Figure 2.9.2c. Red fox captured near a water point by camera trap 5.

Figure 2.9.2d. Arabian wildcat captured near water by camera trap 11.

Figure 2.9.2e. Two Arabian hares captured at other location by camera trap 14.

2.9.3. Discussion and conclusions for camera trapping

Camera traps were set for five days during the 2020 expedition and still provided a good return of pictures relevant to the trapping effort (80 trapping days). A total of 6,609 pictures were recorded from 14 camera traps, with 12 species identified. The majority of pictures captured were of native fauna (83%) (Table 2.9.3a). The most frequently recorded species was Arabian oryx with 4,831 pictures, which is 87% of the total animal pictures recorded. 306 Arabian gazelle (5.52%) and 133 sand gazelle (2.40%) were also recorded, with remaining species results in Table 2.9.3a.

The mean of images recorded on the natural sites (other) is 22.4 images recorded per camera trap and the mean for the images recorded on water sources is 721.56 images per camera trap (Table 2.9.3b). This clearly shows the importance of water for many animal species. Still, rare species such as the Arabian hare were recorded from the camera traps on other sites.

Table 2.9.3a. Results of camera trapping 2020, the total number of animals counted in images.

Species	Images recorded	% of Images	Total no. of animals in images	Group size (min.)	Group size (max.)
Arabian oryx	4831	87.11	13244	1	20
Arabian gazelle	306	5.52	438	1	5
Sand gazelle	133	2.40	167	1	4
Arabian red fox	22	0.40	22	1	1
Arabian wildcat	9	0.22	9	1	1
MacQueen's bustard	2	0.04	2	1	1
Arabian hare	21	0.38	24	1	2
Grey francolin	3	0.05	5	1	2
Brown-necked raven	3	0.05	3	1	1
Laughing dove	8	0.14	8	1	1
Rock dove	14	0.25	25	1	3
Eurasian collared dove	142	2.56	616	1	19
Gazelle unidentified	3	0.05	3	1	1
Dove unidentified	46	0.83	120	1	8
Total	**5546**		**14689**		

Table 2.9.3b. Mean of the results of camera traps images from the artificial water and other sites in 2020.

Site type	Total number of images	Fauna	Blank	Pick-up / set-up	Human	Not identifiable
Other	22.4	8.4	8.4	4	1.2	0.2
Artificial water	721.6	611.5	49.0	6.4	61.5	0.1

During the 2019 expedition, the camera trapping effort was double compared to this year (203 trapping days), yielded a record number of pictures: 21,697, showing 29 species. The camera trapping during the 2020 expedition did not record any of the target species with significant importance for the reserve such as sand fox, lappet-faced vulture and pharaoh eagle-owl. However, they were observed during the expedition. This result is mainly due to the short period and hence effort made for camera trapping (five days only) when compared to the previous year (13 days), as well as placing six camera traps on other natural locations, not only at artificial water sources, to which more animals are drawn.

Among the target mammal species within the DDCR, the rare Arabian wildcat was recorded and confirmed for a second year in a row from the same location by camera trap. Arabian red fox was also recorded by four camera traps. Rare species records such as Arabian hare recorded by camera trap number 14 from a natural site was also a good result. Continued camera trap surveys therefore continue to be an important aspect of monitoring target species in the DDCR.

2.10. Management considerations and recommendations for further expedition work

Over the years the relatively high numbers of ungulates within the DDCR, especially the Arabian oryx, continue to be a challenge in terms of the need to balance animal welfare with the health of the desert ecosystem. Supplying supplementary forage for the Arabian oryx herd addresses both of these aspects by making additional nutrition available to individuals while limiting the impact of overgrazing on the ecosystem. However, supplementary feeding also contributes to the continued growth of the populations, which is not sustainable because resources, natural and supplied, are limited. Therefore, in order to reduce the number of ungulates in the reserve, management has succeeded in gaining approval, and has started construction of, ungulate holding enclosures outside the reserve perimeter. These enclosures have been designed so that the DDCR management will be able to separate the sexes and effectively stop population growth. These surplus animals will then be made available for translocation to other reserves within the natural home range of the species. A reduction in the ungulate population within the DDCR will hopefully lead to better vegetation and a distribution more dependent on habitat type and quality, rather than supplementary feed and enhanced (irrigated) habitats. Predator re-introduction sought previously has not been approved at this time by the authorities, but is still under consideration.

Arabian red fox den surveys have shown a declining trend of active dens, but other indications, from camera traps and sightings, suggest a steady population. The decline in the number of active dens surveyed does warrant further investigation over a larger area to gain a better understanding of the Arabian red fox population in the DDCR.

Recommendations for the 2022 expedition

The 2021 expedition, planned for January of that year, could not take place because of the coronavirus pandemic. It is hoped the expedition can return in January 2022, when it should continue the five survey activities described in this report, to concentrate and improve on the following:

- Feed spot counts for the ungulate species should be conducted during the early hours of the day.

- During each circular and random observation, the group structure and composition of ungulates should be recorded for each group observed.

- More efforts should be made by participants to observe and identify the greater hoopoe-lark and Arabian great grey shrike during the circular and random observations in DDCR.

- The red fox den survey should be expanded in training and effort to discover new dens. Intensive systematic surveys for dens should be carried out, covering all 62 quadrants in the reserve to elucidate population status.

- Live trap numbers will be increased to six traps in all three zones with a total of at least 60 trapping nights.

- Morphological data should be collected for each captured rodent and captured individuals should be marked to enable population estimation of small mammals in each trapping grid, through mark/recapture analysis.

- Camera trapping should be continued with the locations selected for the 2020 expedition, with ten camera traps at water sources and six on other natural sites to increase the chances of recording cryptic species.

2.11. Literature cited

Bell, S & Khafaga T., (2015), Assessment of terrestrial small mammals in Dubai Emirate's inland desert. wildlife Middle East, Vol 7, Issue 2, ISSN1990-8237.

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Strauss, M, Sher Shah, M., and Shobrak, M. (2008) Rodent trapping in the Saja/Umm Ar-Rimth Protected Area of Saudi Arabia using two different trap types. Journal of Zoology in Middle East 43, 2008: 31-39.

Appendix I: Expedition reports, publications, diary & further information

Project updates, reports and publications:
https://www.researchgate.net/project/UAE-Protecting-desert-habitats-and-species-of-the-Dubai-Desert-Conservation-Reserve-through-citizen-science

All expedition reports, including this and previous expedition reports:
https://www.biosphere-expeditions.org/reports

Expedition diary/blog:
https://blog.biosphere-expeditions.org/category/expedition-blogs/arabia-2020/

Expedition details, background, pictures, videos, etc.
https://www.biosphere-expeditions.org/arabia