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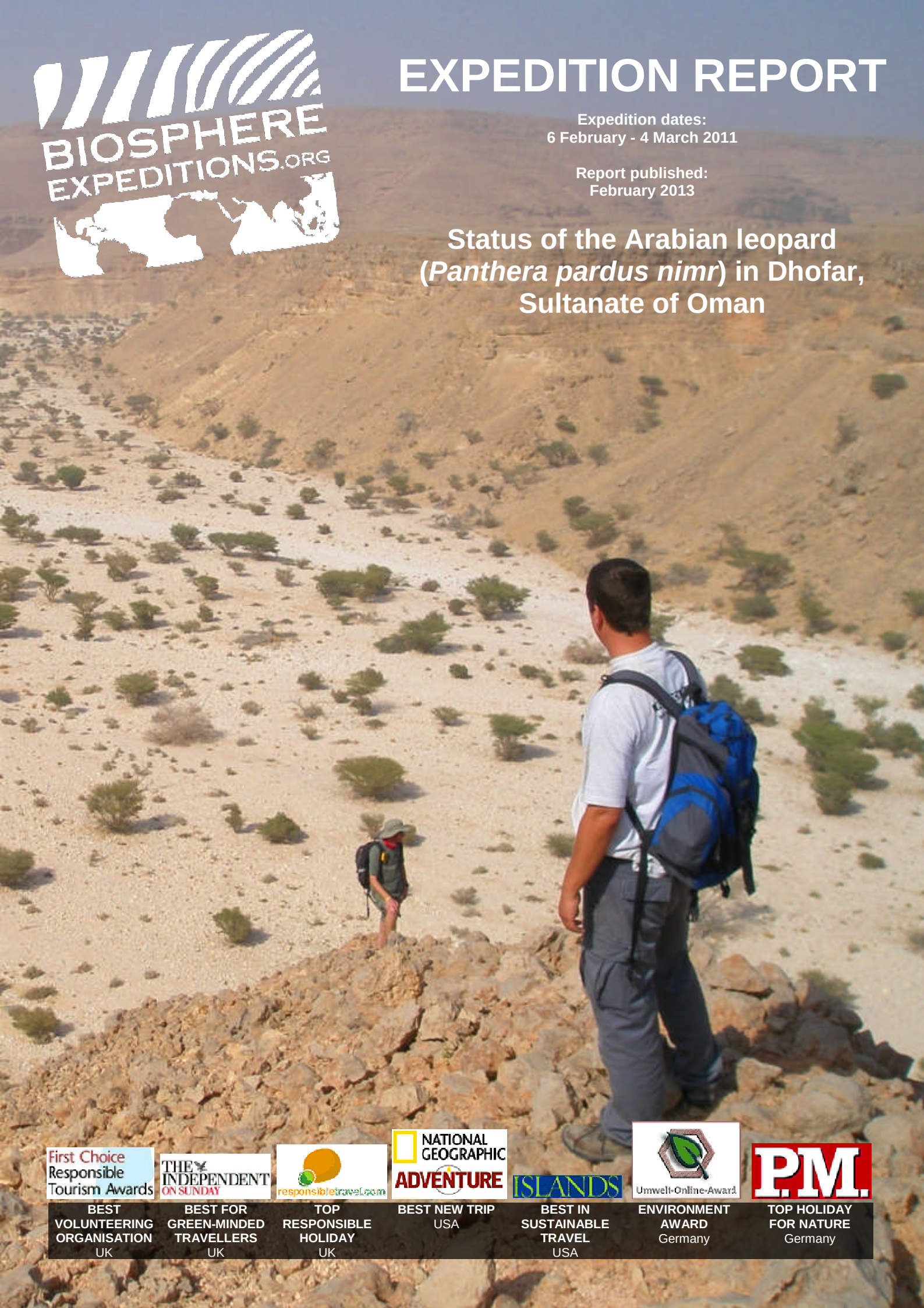
EXPEDITION REPORT

Expedition dates:
6 February - 4 March 2011

Report published:
February 2013

Status of the Arabian leopard (*Panthera pardus nimr*) in Dhofar, Sultanate of Oman



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Status of the Arabian leopard (*Panthera pardus nimr*) in Dhofar, Sultanate of Oman

Expedition dates:
6 February - 4 March 2011

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Author:
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Projeto Puma, Brazil

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Office of the Advisor for Conservation of the Environment
Diwan of Royal Court, Oman

Matthias Hammer & Adam Stickler (editors)
Biosphere Expeditions

Abstract

The Arabian Leopard *Panthera pardus nimr* is a flagship species for Oman's mountain habitats. It is classified by IUCN as Critically Endangered and is listed on Appendix 1 of the convention on International Trade in Endangered Species (CITES) having disappeared from most of its former range on the Arabian Peninsula. Most of the remaining wild population is confined to the mountains of southern Oman and Yemen.

Much knowledge on the status and biology of the Arabian leopard has been gained since the inception of the Leopard Survey Project in 1997. Despite this, many basic questions remain unanswered, including the most relevant of all; the exact causes and processes that appear to be driving leopard populations into a steady decline. Biosphere Expeditions has been working in collaboration with the Office of Conservation for the Environment, Diwan of Royal Court since 2006. The intent is to gain an understanding of aspects of leopard biology and the animal's interaction with humans. This can be used to inform future management strategies and cooperative actions that are relevant to the conservation of the Arabian leopard in Oman.

Biosphere Expeditions surveys conducted in Musandam (2006-2007) indicated that the leopard population on the peninsula was very small, as indicated by low recording rates and loss of two important prey species, the Arabian tahr *Hemitragus jayakari*, the gazelle *Gazella gazella cora* and that of the other top carnivore, the Arabian wolf *Canis lupus arabs*. The subsequent 2008-2010 expeditions to the Dhofar mountains north and west of Salalah have reported better habitat quality with the large mammals and prey base still present. However, it was found that the Arabian leopard is also uncommon in this part of its range. This area of Dhofar, encompassing the Jabal al Qara range, is strategically positioned between two relatively good leopard populations from Jabal Samhan and the Yemen border. This report covers the continuation of the survey work in the Jabal al Qara, at Wadi Uyun, conducted from February to March 2011.

Sixty six cells 2 x 2 km in size were surveyed within a 32 x 36 km area, which ranged from Wadi Uyun (north) to the cliffs facing the Salalah plains. It covered a varied topography from wadi floors to mountain ridges and escarpments. Vegetation coverage increased towards the monsoon-showered regions at the south range of the study area. Methods included the identification of signs, DNA analysis of scats, visual recording and employment of 20 camera traps, all to identify distributional range and consecutive recording ('capture-recapture') of targeted mammals as alternative variables to abundance. Capacity-building and education initiatives were also part of the expedition.

Target species where those mammals highly detectable by any of the sample methods employed when present, meaning that absence or reduced presence of such evidence was assumed to represent rareness. It was found that mountain gazelle, porcupine *Hystrix indica*, Nubian ibex *Capra ibex nubiana*, striped hyaena *Hyaena hyaena sultana* and hyrax *Procavia capensis* were common throughout most of the study area. Arabian wolf, caracal *Caracal caracal* and Arabian leopard were the least recorded and were thus considered less common than other target species.

Efficiency of methods in the way they contributed to detect species in cells varied for each species. Wolves and hyaena were recorded more widely by tracks; caracal by DNA analysis; gazelle by tracks, scats and sightings; ibex by tracks and scats; porcupine and hyrax by scats. Regarding aggregation and abundance, wolves were clearly restricted to the south of the study area, gazelles were detected mostly in the north and ibex in the centre of the study area. No patterns of aggregation were found for the other species.The relationship of such aggregations and species composition on leopard presence is yet unknown.

Gazelle and hyaena proportionally displayed a larger number of cells occupied when compared with data collected using the cell methodology in 2008. The increase in gazelle occupancy is compatible with the increasing number of counts of gazelle since 2009.

The current study identified leopard presence in a single location, based on DNA analysis of scats, in the cell neighboring the base camp cell. Intensive surveys were also conducted at a water source, the oasis of Uyun, with no results of leopard presence. That, combined with the fact that no other definitive proof of leopard presence was found, corroborates the findings of Mazzolli and Hammer (2008) and Mazzolli (2009) that leopard is uncommon in the area. This conclusion is further supported when the low or null rate of leopards verified from vestiges and/or camera traps found in the study area is compared with the higher rates obtained in the extreme west and east of the Dhofar mountains, by the Office of the Adviser for Conservation of the Environment – OACE (unpubl. data).

The low occurrence of leopards is consistent with the reported low or null depredation rates. Livestock is common in the south of the study area and information collected from interviews suggests that losses to predation are rare. Thus the predation rate of leopard taking livestock should be low. This makes the low numbers of leopard intriguing. With healthy and widespread populations of wild prey, the only other obvious cause of leopard rareness would be retaliation following livestock depredation. Clearly more research should be done to investigate the causes of low leopard numbers in the area.

ملخص

يعتبر النمر العربى من الأنواع الحيوانية البرية الرئيسية الممثلة للبيئات الجبلية العمانية، تم تصنيف النمر العربى تبعاً للأتحاد الدولى للحفاظ على الطبيعة (IUCN) كنوع شديد التهديد ومعرض لمخاطر الأنقراض ووضع فى الملحق (1) لمعاهدة منع الأتجار فى الكائنات الحية (سايتس) وذلك لأختفاء ذلك النوع من معظم بيئات الجزيرة العربية والتى كان منتشر بها فى الماضى القريب. معظم الأفراد المسجلة حالياً منحصرة فى بعض المناطق الجبلية الجنوبية لدولتى سلطنة عمان والجمهورية اليمنية.

معظم البيانات الحقلية والمعلومات الخاصة بالنمر العربى تم الحصول عليها وتجميعها من خلال الرحلات البحثية لمشروع حصر النمر العربى فى عام 1997م وبالرغم من ذلك فمازالت هناك العديد من الأسئلة المحيرة والتى ليست لها أجابات واضحة حتى الان. السؤال الاكثر أهمية من بين كل التساؤلات المطروحة هو: ماهى الاسباب الحقيقية التى أدت إلى إنخفاض أعداد ذلك النوع حتى وصل ألى مرحلة التهديد بالإنقراض، لذلك قامت مجموعة رحلات المحيط الحيوى (بيوسفير أكسبيدشن) وبالتعاون مع مكتب الحفاظ على البيئة والتابع لديوان البلاط السلطانى منذ عام 2006 بالدراسات المستفيضة سنوياً لذلك النوع، كان الهدف الأساسى هو الوصول للفهم الكامل لجميع جوانب حياة النمر العربى وكيفية تفاعل الحيوان مع البشر مما يسهل مستقبلاً من حملات التوعية للحفاظ على ذلك النوع وكذلك وضع الخطط والأستراتيجيات المناسبة للحفاظ عليه وتنميته فى سلطنة عمان.

أوضحت نتائج الدراسات التى تمت على النمر العربى خلال الفترة من (2006م وحتى 2007م) أن أعداد النمر العربى التى تم تسجيلها قليلة جداً إلى نادرة وذلك نتيجة لإنخفاض أعداد الفرائس الرئيسية التى يتغذى عليها النمر وهما (الظهر العربى والغزال الإدمى) وكذلك المنافسة فى الغذاء والتى يواجها النمر العربى مع الحيوانات المفترسة الرئيسية الأخرى مثل الذئب العربى، خلال السنتين اللاحقتين (2008م وحتى 2010م) تم تحديد مايمكن أن يكون نوعية موائل مناسبة للنمر العربى فى جبال ظفار وكذلك غرب منطقة صلالة مع توافر نوعية الفرائس المناسبة والتى يمكن للنمر العربى ان يتغذى عليها. ومع ذلك، وجد بعد إنتهاء الحصر ان النمر العربى مازال غير شائع بتلك المناطق، تشمل منطقة جبال ظفار على سلسلة جبال قره والتى تعتبر موقع إستراتيجى بين تجمعين رئيسيين للنمر العربى والواقعة بين جبل سمحان والحدود اليمنية.

يغطى هذا التقرير المسوحات المتتالية فى مجموعة جبال قره وكذلك منطقة وادى عيون والتى تمت خلال الفترة من فبراير وحتى مارس 2011م، تمت دراسة ستة مواقع رئيسية مساحة كل موقع (2كم 2x كم) داخل المساحة الإجمالية للدراسة والتى كانت تبلغ (36كم x 36كم) وتراوحت من منطقة وادى عيون شمالاً إلى المنحدرات السهلية المواجهة لمدينة صلالة، قامت الدراسة بتغطية العديد من التضاريس المتنوعة ممثلة لبيئات الوديان الجبلية وكذلك بيئة المنحدرات الجبلية وتمت ملاحظة ان الغطاء النباتى يزداد كثافة كلما أتجهنا إلى المناطق المعرضة للأمطار الموسمية الإستوائية (ظاهرة المونسون) جنوب منطقة الدراسة.

شملت الدراسة تحديد العلامات وتحليل الحامض النووى للمخلفات البرازية للحيوانات البرية وكذلك إمكانية التسجيل المرئى للحيوانات البرية بواسطة الكاميرات (أفخاخ الكاميرا) بتركيب 20 كاميرا فى أماكن مختلفة لتحديد نطاقات تواجد وإحتمالية أنتشار النمر العربى فى تلك المناطق، بالإضافة إلى الناحية التعليمية والتثقيفية للدراسة من خلال بناء القدرات للباحثين والمهتمين بالحياة البرية وعن النمر العربى خصوصاً والتى أعتبرت جزاءاً أساسياً ومكملاً للدراسة، تم بالإضافة إلى ذلك مراقبة وتسجيل بعض الثدييات الاخرى فى منطقة الدراسة عن طريق (الأصطياد ثم إعادة الإطلاق) لتلك الحيوانات كعامل مساعد بديل لتحديد وفرة الأنواع الموجودة بالمنطقة، من خلال تلك الدراسة أمكن تحديد الندرة لكل نوع من الأنواع الثديية المسجلة بمنطقة الدراسة حيث وجد أن الغزال الادمى والوعل النوبى والضباع والوبر من الثدييات الشائعة فى معظم مناطق الدراسة ولكن الذئب العربى والوشق والنمر العربى كانت أقل تسجيلاً فأعتبرت أقل شيوعاً من الانواع المستهدفة الأخرى.

أختلفت فاعلية الطرق المستخدمة لتسجيل الانواع الثديية من نوع لأخر تبعاً لطبيعة كل نوع ومدى وفرته بمنطقة الدراسة، فقد تم تسجيل تواجد الذئاب والضباع عن طريق أثار الأقدام وكذلك فحص وتحليل المخلفات البرازية لتلك الحيوانات ولكن حيوان ثديى أخر مثل الوبر تم تسجيل تواجده عن طريق فحص المخلفات البرازية، فيما يتعلق بتجمع الأنواع الأخرى ووفرتها وجد أن الذئاب العربية تتركز فى المناطق الجنوبية لمنطقة الدراسة وأن توزيعات الغزلان تتركز فى المناطق الشمالية للدراسة ويتواجد الوعل النوبى فى وسط منطقة الدراسة ومع ذلك لم يتم تفسير أو التعرف على أنماط توزيع وتواجد النمر العربى بمنطقة الدراسة لعدم تسجيل ووجود الاعداد المناسبة لتأكيد تلك الفرضية.

يجب التنويه انه قد تم تسجيل الضباع والغزلان فى معظم مناطق الدراسة، وكان من نتائج تلك الدراسة أيضاً ان تم التعرف وتحديد مكان واحد فقط بمنطقة الدراسة يتواجد فيه النمر العربى وكان ذلك نتيجة لتحليل الحامض النووى لبعض المخلفات البرازية التى عثر عليها بالمنطقة بالقرب من مكان إقامة الفريق البحثى وبالقرب من أحد الأبار كمصدر للمياه العذبة بالمنطقة، ونتيجة لذلك تم تكثيف البحث فى أحدى المناطق وفيرة المياه (واحة عيون) ولكن للأسف لم يتم تسجيل أى تواجد للنمر العربى بتلك المنطقة مما أكد الدراسات السابقة ان النمر العربى غير شائع التواجد بتلك المنطقة وتم تأكيد ذلك أيضاً بعد دراسة نتائج تحليل الصور والمشاهدات التى تم تسجيلها بواسطة كاميرات المراقبة ومقارنتها بالمناطق الأخرى والتى يتواجد بها النمر العربى بوفرة.

بالإضافة للنتائج السابقة تم توثيق المعدلات المنخفضة لتواجد النمر العربى عن طريق تسجيل معدلات إفتراس قليلة إلى نادرة بالمنطقة محل الدراسة بالرغم من توافر العديد من الفرائس المتاحة للنمر العربى والمتمركزة فى جنوب منطقة الدراسة وكذلك تم تأكيد تلك الفرضية من خلال إجراء العديد من المقابلات مع أهالى المنطقة والتى أشارت إلى ندرة الخسائر الناتجة عن إفتراس الثروة الحيوانية المستأنسة بالمنطقة وبالتالى يستنتج من ذلك ندرة الحيوانات البرية المفترسة بالمنطقة وقد يكون تلك الندرة للحيوانات المفترسة بالمنطقة نتيجة للقتل الجائر الذى تم فى الماضى من قبل الأهالى عندما تعرضت ثرواتهم الحيوانية لخطر الإفتراس ومع ذلك يظل السؤال الاهم والذى ينبغى ان يستتبعه العديد من الدراسات البحثية للأجابة عن أسباب إنخفاض أعداد النمر العربى بالمنطقة محل الدراسة؟!!!!

Contents

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

1. Expedition Review

M. Hammer & A. Stickler (editors)
Biosphere Expeditions

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. 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. Expeditions are open to all and there are no special skills (biological or otherwise) required to join. Expedition team members are people from all walks of life and 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 expeditions to the Dhofar area in southern Oman, which ran from 6 February to 4 March 2011. The expedition assisted local scientists from the Office for Conservation of the Environment, Diwan of Royal Court (OCE) in ascertaining the status of the Arabian leopard in parts of the remote and mountainous Dhofar region of Oman. The expedition searched for leopard signs and attempted to camera trap animals in potentially prime leopard habitat, completed a wildlife inventory of the area, strengthened ties with local people and investigated historical records of leopard presence.

The Arabian leopard is a flagship species for Oman's mountain habitats. It once occurred throughout the mountainous regions of Oman, Yemen, Saudi Arabia, the United Arab Emirates, Palestine and Jordan. However, by the 1990s the leopard became locally extinct in most areas of the Arabian Peninsula. If viable populations remain, they are most likely to be found in the high mountains of Oman and Yemen.

The Arabian leopard is the largest surviving cat species of Arabia. Listed as "critically endangered" in the IUCN List of Threatened Species, it is on Appendix 1 of the Convention on International Trade in Endangered Species (CITES – www.cites.org), which strictly regulates international trade in listed animals.

In 1997 the OCE began a survey of the Arabian leopard in Jabal Samhan Nature Reserve in Dhofar, where a strong population has been shown to exist. However, the one other area of Oman where the leopard may survive, namely the Musandam peninsula, had not been surveyed until Biosphere Expeditions conducted a study in 2006 and 2007. From 2008 and onwards, Biosphere Expeditions conducted studies at the Dhofar Mountains, credited to be the best habitat for the Arabian leopard in the Arabian Peninsula.

1.2. Research area

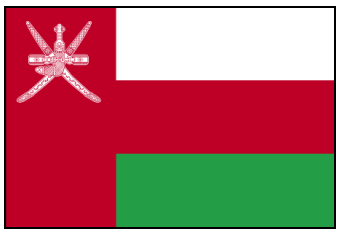

Figure 1.2a. Flag and location of Oman and study site. An overview of Biosphere Expeditions' research sites, assembly points, base camp and office locations is at Google Maps.

Oman is the third largest country in the Arabian Peninsula, with a population of 2.3 million. It maintained its independency throughout its history except for brief occupations by Persians and the Portuguese. The Dhofar Mountains in southern Oman run eastward from the Republic of Yemen to the southernmost eastern tip of Oman. Salalah is the region's largest town and have commercial importance thanks to its port. The local economy also benefits from fishing and Frankincense harvesting. In areas along the coastline with good irrigation or rainfall, fruits such as dates, coconut and bananas are produced. There is very extensive farming of livestock including camels, cattle and goats.

Geology

Oman is located on the Arabian plate, which includes the Arabian Peninsula, the shallow Arabian Gulf and the Zagros mountains of Iran. For most of its history, it has been part of the larger Afro-Arabian continent until 25-30 million years ago when the Red Sea began to open and separate the Arabian and African plate. Presently the plate is moving at a rate of 2 to 3 cm per year away from the African plate.

The mountains of Dhofar in the south and the al Hajar Mountains in the north have different origins. Those of Dhofar were uplifted as part of the process creating the Red Sea and Gulf of Aden, which began about 30 million years ago. The origins of Al Hajar can be traced back 300 million years.

1.3. Dates

The expedition ran over two periods of four weeks divided into two two-week slots, each composed of a team of international research assistants, guides, support personnel and an expedition leader. Expedition slot dates were

6 - 18 February | 20 February - 4 March 2011

The expedition was conducted in winter to avoid the extreme heat of summer for best weather and working conditions.

1.4. Local conditions & support

Expedition base

The expedition base consisted of a Bedu style tented camp, with a Bedu mess tent and some more modern dome tents for sleeping in. An expedition cook was part of the team so vegetarians and other special diets could be catered for. There was very limited electricity at the field base. The circuit was a car battery based 12V DC cigarette lighter plug and socket system.

Field communications

There was an (emergency) satellite telephone at base. Mobile phones did not work in and around camp, nor did they work around much of the study site. In the field, two-way radios were used for communication between research teams wherever possible. The expedition leader sent an expedition diary to the Biosphere Expeditions HQ every few days (see appendix 10) and this diary appeared on the Biosphere Expeditions website at www.biosphere-expeditions.org/diaries for friends and family to access.

Transport and vehicles

Team members made their own way to the assembly point in Muscat. From there the team boarded a one-hour flight to Salalah and then drove about three hours to base in the expedition Land Rovers. Throughout the expedition all transport and vehicles were provided for the expedition team, for expedition support and emergency evacuations. Courtesy of Land Rover Middle East & Africa in Dubai, the expedition had the use of four LR4s and support from Land Rover Middle East & Africa in Dubai and the local dealers MHD in Muscat and Salalah.

Team members wishing to drive the Land Rovers had to be older than 21, have a full clean driving licence and a new style EU or equivalent credit card sized driving licence document. Off-road driving and safety training was part of the expedition.

Medical support & insurance

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. The standard of medical care in Oman is high and further medical support was available at government health posts in rural areas and a government hospital in Salalah.

All team members were required to carry adequate travel insurance covering emergency medical evacuation and repatriation. Emergency evacuation procedures were in place. There were no medical or other incidents during the expedition and emergency procedures did not have to be invoked.

1.5. Expedition scientists

The expedition's scientist was Dr. Marcelo Mazzolli. Born in Brazil, he graduated in Biology in 1992, with a master's degree from the University of Durham, UK. His Ph.D. in ecology, obtained in Brazil, was on the effects of human occupation on the extinction of large mammals. He has devoted his career to the study of large mammals, particularly the puma and jaguar, but has had many other outdoors experiences. He was a professional jungle guide in the Amazon forest in 1986 at age 21. He has attended many national and international workshops, and published relevant scientific articles. His studies have made his work well known, and early in his career he was invited to be a member of the International Union for Conservation of Nature's (IUCN) Cat Specialist Group with one of his projects listed as a priority in the World Wide Cat Action Plan. He has travelled extensively, living in the United States, England, and Peru, and has surveyed lions in Botswana. He is currently a lecturer at a local university in Brazil. Marcelo has been working with Biosphere Expeditions since 2006.

Khaled Mohammed al Hikmani, the expedition's field guide, was born near Jabal Samhan, Dhofar. He joined the Office for Conservation of the Environment in 2007 and is responsible for fieldwork at the Arabian Leopard Survey. He has also worked on projects throughout Oman and joined Biosphere Expeditions on its expedition in Caprivi, Namibia where his experience with Arabian leopards was very useful for Biosphere Expeditions' African leopard work.

1.6. Expedition leader

This expedition was led by Paul o'Dowd. Paul was born in Melbourne, Australia. From the beginning, his primary interests have been natural history and adventure. As a teenager he learned to dive and at 19 years old left Victoria to move to Cairns to work on the Great Barrier Reef in the dive industry. Shortly thereafter he was offered a job managing a dive facility in Papua New Guinea. In PNG Paul became involved in expeditionary and documentary film work. Paul has worked for the BBC's Natural History Unit and various other companies on documentary projects as well as with assorted tourism-based expeditions to places such as the Sepik Basin and the Kokoda Track. Paul also delivers a lecture programme in rainforest ecology, conservation and sustainability for a study abroad programme for American university students. A broad base of scientific literacy and a genuine interest in communication has led to a career in introducing diverse audiences to the natural world. Diving, rock climbing and just about anything that provides a good opportunity to get into nature and help others to do the same is Paul's idea of time well spent.

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 (with countries of residence):

Figure 1.7.a. Group 1 (6 – 18 February 2011), from left to right: Ali Salam Ali Akaak (Oman), Bill Leavey (UK), Marcelo Mazzolli (expedition scientist, Brazil), Gunda Janowski (Germany), Donna Evans (USA), Paul O'Dowd (expedition leader, Australia), Rames Mohammed ali Zabnoot (ranger, Oman), Steven Bell (UAE), John Keller (USA), Martin Haslam (UK), Anne Szittnick (Germany), Sara Salih (Canada) M. Ashraf Uddin (cook, Oman), Thilo Brunner (journalist, Germany). Also on this group for part of the time (and behind the camera): Matthias Hammer (Biosphere Expeditions founder & executive director).

Figure 1.7b. Group 2 (20 February – 4 March 2011), back from left: Stephen Knapp (UK), Björn Streyer (Germany), Olga Aymerich (Belgium), Julia Karstädt (Germany), Giles Keun (UK), Khalid al Hikmani (local scientist, Oman), M. Ashraf Uddin (cook, Oman), Paul O'Dowd (expedition leader, Australia), Mohammed Aoubad Nasser al Hamr al Kathiri (ranger, Oman), Rames Mohammed ali Zabnoot (ranger, Oman), Marcelo Mazzolli (expedition scientist, Brazil), front from left: Jonathan Proud (UK), Toby Whaley (Germany), Berit Askheim (Germany), Dagmar Hofmeister (Germany), Richard Moore (UK), John Garnett (Ireland). Also on this group for part of the time (an not on picture above): Emmanuelle Landais (journalist, UAE), Arun Joseph (UAE), Said Sulaiman Al-Habsi (Oman), Ali Salam Ali Akaak (Oman), Salah Almahthori (biologist, Diwan of Royal Court, Oman),Mansur Aljahdhami (biologist, Office for Conservation of the Environment, Diwan of Royal Court, Oman).

1.8. Expedition budget

Each team member paid towards expedition costs a contribution of £1,390 in 2011 per person per two week slot. The contribution covered accommodation and meals, supervision and induction, special non-personal equipment, all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses like telephone bills, souvenirs etc., as well as visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how this contribution was spent are given below.

Income	£
Expedition contributions	24,605
Expenditure	
Base camp and food includes all board & lodging, base camp equipment	2,564
Transport includes fuel & oils, taxis, flights to Salalah	2,730
Equipment, hardware & educational materials includes all research & educational materials purchased or produced	1,532
Biosphere Expeditions scientists & staff includes salaries, travel and expenses to Dubai & Oman	8,201
Local staff includes cooks, helpers, guides and other locally staffed services	1,716
Administration includes registration fees, visas, sundries etc	621
Team recruitment Oman as estimated % of PR costs for Biosphere Expeditions	6,443
Income – Expenditure	**789**
Total percentage spent directly on project	**97%**

1.9. Acknowledgements

This study was conducted by Biosphere Expeditions, which runs wildlife conservation expeditions all over the globe. Without our expedition team members, who are listed above and 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. Thank you to all of you including the ones we have not managed to mention by name (you know who you are) for making it all come true.

Biosphere Expeditions would also like to thank Land Rover Middle East & Africa and MHD, local dealers in Muscat and Salalah for their support in-country in terms of vehicles, support and press conferences. Further thanks to Motorola, Cotswold Outdoor, Globetrotter Ausrüstung and Gerald Arnhold for their sponsorship. For their help and support in-country we thank the Royal Oman Police, the Royal Air Force of Oman, the Office of the Governor and State of Dhofar and Musandam, the Ministry of Environment & Climate Affairs and the local people who helped with the survey.

1.10. Partners

Our main partner on this expedition was the Office for Conservation of the Environment, Diwan of Royal Court, Muscat, an Oman government department concerned with conservation and initiator of the Arabian Leopard Project in Oman. Other partners included the Ministry for Environment and Climate Affairs, whose rangers we train and work with, the Oman Tourism Board, as well as local communities & schools. Corporate support came from Land Rover & Swarovski Optik, as well as from The Ford Motor Company Conservation and Environmental Grants.

1.11. Further information & enquiries

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

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

2. Arabian leopard & prey survey

Dr. Marcelo Mazzolli
Projeto Puma

Khaled al Hikmani
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Diwan of Royal Court, Oman

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Biosphere Expeditions

2.1. Introduction

Big cats are declining around the world. They need space, good habitat and a sustainable wild prey base. They are indicator species of habitat quality and often referred to as an iconic species (charismatic species representative of particular habitats that people can relate to and are interested to conserve). The Arabian leopard *Panthera pardus nimr* is a flagship species for Oman's mountain habitats. It is classified as Critically Endangered by the IUCN and is listed on Appendix 1 of the Convention on International Trade in Endangered Species (CITES – www.cites.org). The leopard once occurred throughout much of Arabia (Harrison & Bates 1991), but is now restricted to a few isolated populations with a total remaining wild population estimated at fewer than 250 individuals, the largest proportion of which is in Oman (Breitenmoser et al. 2006). Human interference, through depletion of prey base and killing by hunters and shepherds, has been suggested as the main cause of decline (Spalton & Hikmani 2006).

Since the 1980s the Arabian leopard has been a conservation priority for Oman. The first captive breeding group of Arabian leopards was established at the Breeding Centre for Omani Mammals in Muscat. They were caught in Jabal Samhan in 1985. In 1997 the 4,500 km^2 Jabal Samhan Nature Reserve was created, the only protected area for leopard in the Arabian peninsula. Between 1997 and 2000 the Arabian Leopard Survey project recorded 17 individuals by using camera-traps (Spalton et al. 2006a & b). Since 2000 the ongoing programme of camera trapping and radio collaring of leopards has confirmed the continuing presence of leopards elsewhere in the mountains of Dhofar from Salalah, westward to the border with Yemen (Office of the Adviser for Conservation of the Environment - OACE, unpubl. data).

The Dhofar mountains are believed to be the best remaining habitat for leopard in Oman. Nubian ibex *Capra nubiana*, Arabian gazelle *Gazella gazella cora* and hyrax *Procavia capensis* populations are still present there. Within this mountain range, the creation of Jabal Samhan Nature Reserve and the implementation of the Leopard Survey Project were the first steps towards the Arabian leopard's protection. To ensure effective management and conservation, however, additional input from ecological and social studies throughout Dhofar is needed if the threat of extinction in the wild is to be averted.

Since 200, Biosphere Expeditions has concentrated its efforts in the area northwest of Salalah, known as Jabal al Qara. The Arabian leopard was reported to be uncommon in this part of the Dhofar mountains (Mazzolli 2009). This does not diminish the importance of this region, as it is positioned amongst two relatively good leopard populations from Jabal Samhan and the vicinity of the Yemen border (OACE, unpubl. data). Further research is needed on whether the Arabian leopard's rarity is naturally low or whether it has been caused by human interference. This report covers the continuation of survey work in this area of Dhofar, conducted from February to March 2011.

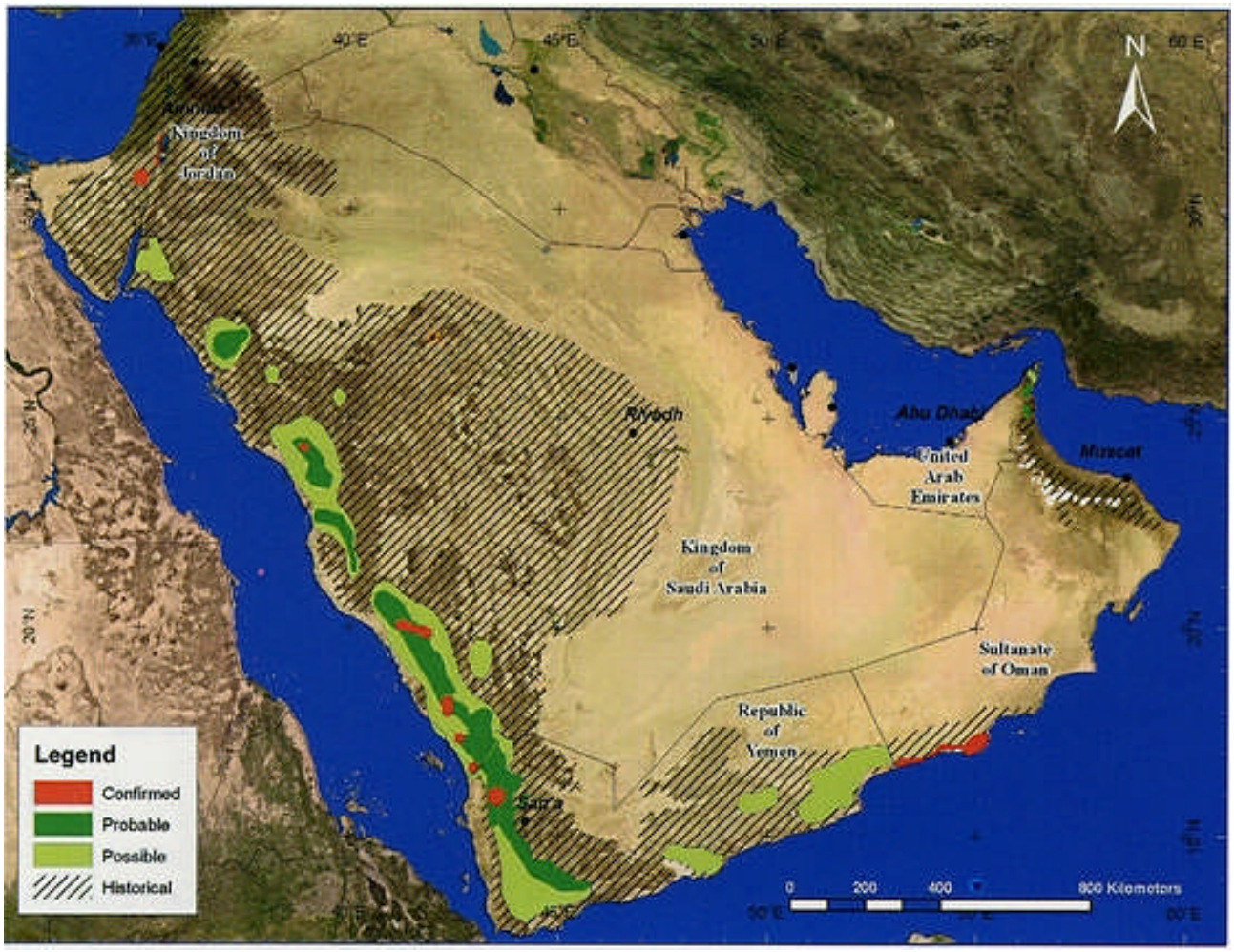

Figure 2.1a. Former and current (since 1990) distribution of leopards on the Arabian Peninsula. Confirmed records include evidence such as dead specimens (with body, skin, etc. available), camera trap pictures and identification through genetic analyses. Probable records include any evidence obtained by a trained person. Possible records include all non-confirmed or not confirmable records including hearsay and direct observations by untrained persons. From Spalton & Hikmani (2006).

2.2. Methods

Study area

The expedition base camp was located in Wadi Uyun in the northwestern area of the Dhofar Mountains, near the village of the same name.

The study site encompassed an area of 32 x 36 km within the Dhofar mountain range known as Jabal al Qara. This area includes the dry Wadi Uyun, vicinities of Titam village, and the Khareef (monsoon) exposed cliffs facing the ocean (namely Jabals Aroqum and Qaffawf (Fig. 2.2a)). These cliffs represent the southernmost tip of the sampled area and they differ from the northern area by having more villages and by harbouring dense stands of Frankincense trees. In contrast the north has more open areas with scattered, but dominant Acacia trees, typical in the fringes of the desert.

The Dhofar mountains form a narrow girdle with a maximum width of 23 km that extends for 400 km east to west from the Halaaniyat islands to the Yemen border. The highest peak is 2,500 metres. The monsoon rains fall on a 75 km stretch of mountains and an 8 km wide plain surrounding Salalah.

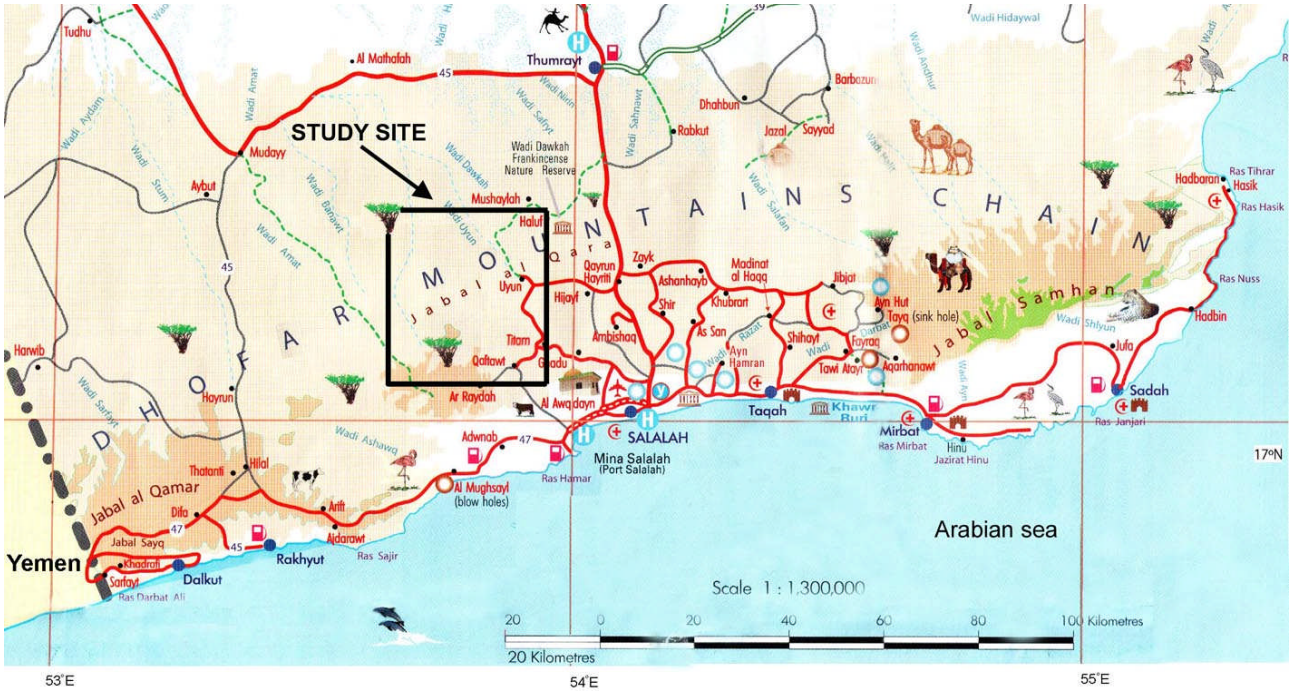

Figure 2.2a. Dhofar mountains in southern Oman, with study area (black square) between Wadi Uyun and the al Kareef-showered cliffs facing Salalah.

From June to the end of September flash floods may occur and the usually dry wadi beds are often transformed into sizeable streams and the dry slopes into green pastures (Barrault 1999).

The umbrella thorn Acacia *Acacia tortilis* dominates the bottom of the wadis. This species is also found in east Sahel, the Nile Valley, the Horn of Africa, Israel, and Jordan (www.fao.org).

Camels were the only livestock found grazing freely in the drier (northern) wadis, whereas donkeys were seen usually on the upper plateaus. Cattle and goats were seen near villages, particularly near the al Kareef-showered areas. While cattle ranged freely, local herders usually accompanied goats. Old vestiges of goat presence were, however, seen frequently down in most wadis. Goats, the most vulnerable livestock to leopard attacks due to their small size, are herded down to the drier wadis only when enough moisture creates conditions for green leaves to sprout. During this time, young goats are often kept in small rock pens, seen throughout the study area, to ensure protection from predators.

GIS and mapping

The main reference map used was a topographic map called Uyūn, indexed as NE 39-12F at 1:100,000 scale and produced under the supervision of the Head of the National Survey Authority (NSA), Sultanate of Oman, using aerial photographs dating from 1993 and field updates by NSA in 1999. Grid data was in Universal Transverse Mercator projection, covering zones 39 and 40 and datum WGS 84.

A GIF image of the area was imported and geo-referenced into the GIS program TrackMaker (www.gpstm.com), a freeware program. A grid of 400 2x2 km cells covering the study area was uploaded into the expedition's GPS units (Garmin GPS60) (of which a fraction was actually surveyed) to aid navigation and data collection. As the work progressed, additional features such as access roads, base camp, trails and camera trap locations were added to the GPSs and overlaid onto the topographic map in TrackMaker.

The topographic map with added features was edited and redrawn in Adobe Photoshop in order to leave only the features of interest.

Training

Training included an introduction to leopard conservation issues, the role of Biosphere Expeditions in the Leopard Survey Project and the methods of recording presence of species using GPS and datasheets.

Before team members were split into small groups to perform different tasks, an introductory survey was performed as part of the training process. During this survey, tracks and scats of known species were shown. To reduce identification errors, team members were instructed to bring scats to base camp whenever they were unable to identify the species. They were also briefed on how to take photos of tracks for identification later at base.

The large surveying team provided by Biosphere Expeditions helped to cover a substantial geographical area in a short time. It meant that chances of finding sign of Arabian leopard and other wildlife were maximised by having many people fully engaged in looking for vestiges.

Sampling

The 32 x 36 km study area was divided into 2 x 2 km cells and coded by numbers in the X-axis and by letters in the Y-axis. Except during the first couple of days of training, team members were tasked to cover at least two cells during daily survey trips, a sampling practice that provided a good compromise between detailed surveying and inclusion of adequate habitat heterogeneity. Following the presence/absence method of occupancy (MacKenzie et al. 2002), the presence of prey species and large carnivores was recorded using the general location given by a cell code, and once a species or its signs were found in a given cell, it was scored as containing the species.

Occurrence by cell, i.e., the extent of the range of each species, and the temporal frequency of occurrence were considered alternative variables for abundance. Only a few species were selected as targets for quantitative analysis of presence allowing ecological evaluation.

During the 2011 expedition, scats presumed to be of leopards were collected for identification by DNA analysis. Coordinates were recorded, thus allowing the field crew to return to the same exact location if needed, either to check the signs or to install camera traps where judged suitable.

Sampling was by and large done on foot and usually started at the bottom of the wadi. At least two promising ledges (those that were long enough to be used as trails) were also sampled in each cell. There is a need to cover large areas so that the survey can better represent the leopard population. Furthermore, it is recommended that rare species should be surveyed in more locations less intensively than few locations intensively (MacKenzie & Royle 2005). For this reason, teams were encouraged to cover two 2 x 2 km cells during the daily surveys.

Teams usually left in the morning and returned to base in the afternoon when surveying cells near base camp. Overnight surveying was not attempted, as all surveyed sites were within relatively short distances from base.

Twenty digital and infra-red camera traps (www.cuddeback.com) were set throughout the study area. The cameras were installed in areas in which the field team perceived as good spots to produce photos of leopard.

Other species, particularly birds, were recorded whenever possible.

DNA analysis of scat samples

DNA analysis aimed to assign species to each scat was performed by E. Eizirik, T. Haag, and B.G. Lippert, from the Laboratory of Genomic and Molecular Biology of the Catholic University of Rio Grande do Sul (PUCRS) in Brazil. Extractions from scat samples were performed with the QIAamp DNA StoolMini Kit (QIAGEN), following the manufacturer's instructions. Scat DNA extractions were carried out in a separate laboratory area, in a UV-sterilised laminar flow hood dedicated to the analysis of DNA from noninvasive samples. Each batch of extractions (n = 10) included one negative extraction control to monitor the occurrence of contamination with extrinsic DNA.

To assign species to each scat an assay that targets a short segment of the mtDNA *ATP synthase subunit 6* (*ATP6*) gene using the reverse primer ATP6-DR1 and the forward primer ATP6-DF3 was used. Polymerase chain reactions (PCR) for the ATP6 gene were employed, following the protocols described by Haag et al. (2009).

The PCR products were visualised on a 1% agarose gel stained with GelRed (Biotium), purified with >PEG8000, sequenced using the DYEnamic ET Dye Terminator Sequencing Kit (GE Healthcare) and analysed in a MegaBACE 1000 automated sequencer (GE Healthcare). Sequence chromatograms were edited and analysed using the software Finch TV Version 1.4.0 (Geospiza, Inc., USA). The *ATP6* gene fragment obtained from each fecal sample was compared with database reference sequences.

Outreach activities

Involvement of the local communities, either through locally recruited staff, interviews, talks in schools, or distribution of educational material, was an important part of the project. Time was spent with local people in their villages, settlements and surrounding areas in order to gather local knowledge about the area and to investigate the level of human/wildlife conflict and learn about local attitudes to wildlife and natural resources. Team members helped by assisting with recording data gathered during interviews.

Arabian leopards, like other large predators, are a potential threat to domestic livestock. Livestock depredation is the main source of human-predator conflict throughout the world (Graham et al. 2004), and often ends with the predator being persecuted and killed (e.g. Mazzolli et al. 2002). It is likely that, in Oman also, people consider leopards a threat to their domestic stock (Spalton et al. 2006a & b). In spite of this, nothing is known of the frequency that leopards actually kill livestock, presumably intensively in Jabal Qara (study area) and Qamar, where leopards range near settlements, and where domestic stock density is high (Spalton et al. 2006a & b). For these reasons, interviews to asses potential human-predator conflicts were conducted.

2.3. Results

Species monitoring

Sixty-six cells 2 x 2 km in size were sampled within the study area (Fig. 2.3a), some of which were also resampled a number of times. Thirteen species of medium and large mammals were recorded (Appendix 1), some of were target species, i.e. those that were relevant to describe leopard habitat conditions (including presence of prey and competitors), yielding quantitative information that could be analysed to detect population trends and spatial aggregations. From the 32 scats presumed to have any chance of being from a leopard, 24 were successfully amplified, and only one (4.2%) was in fact leopard.

Compared to the 2008 data collected mainly in Wadi Amat located to the north of the study area, new species were added to the quantitative analysis, for different reasons. The most remarkable is the wolf, not detected at all in 2008, corroborating that its distribution is indeed mainly in the south of the study area. McGregor et al. (2011) and Spalton (personal communiciation) also report wolves in the northern area, but it is very clear from our intensive screening of the area with multiple survey methods that it is uncommon there and more common in the south. In contrast to 2008, enough information for quantitative analysis was recorded for caracal based on a couple of records from camera traps, used more intensively here, and most records from DNA analysis, as employed in 2008. In the case of porcupine, it was not often recorded in 2008 probably a result of uncertainties regarding correct identification of scats at the time and low occurrence of tracks (Table 2.3a). Regarding occurrence of species that had substantial quantitative records in 2008, differences to the current study varied from 8 to 16.5% in occupation of cells.

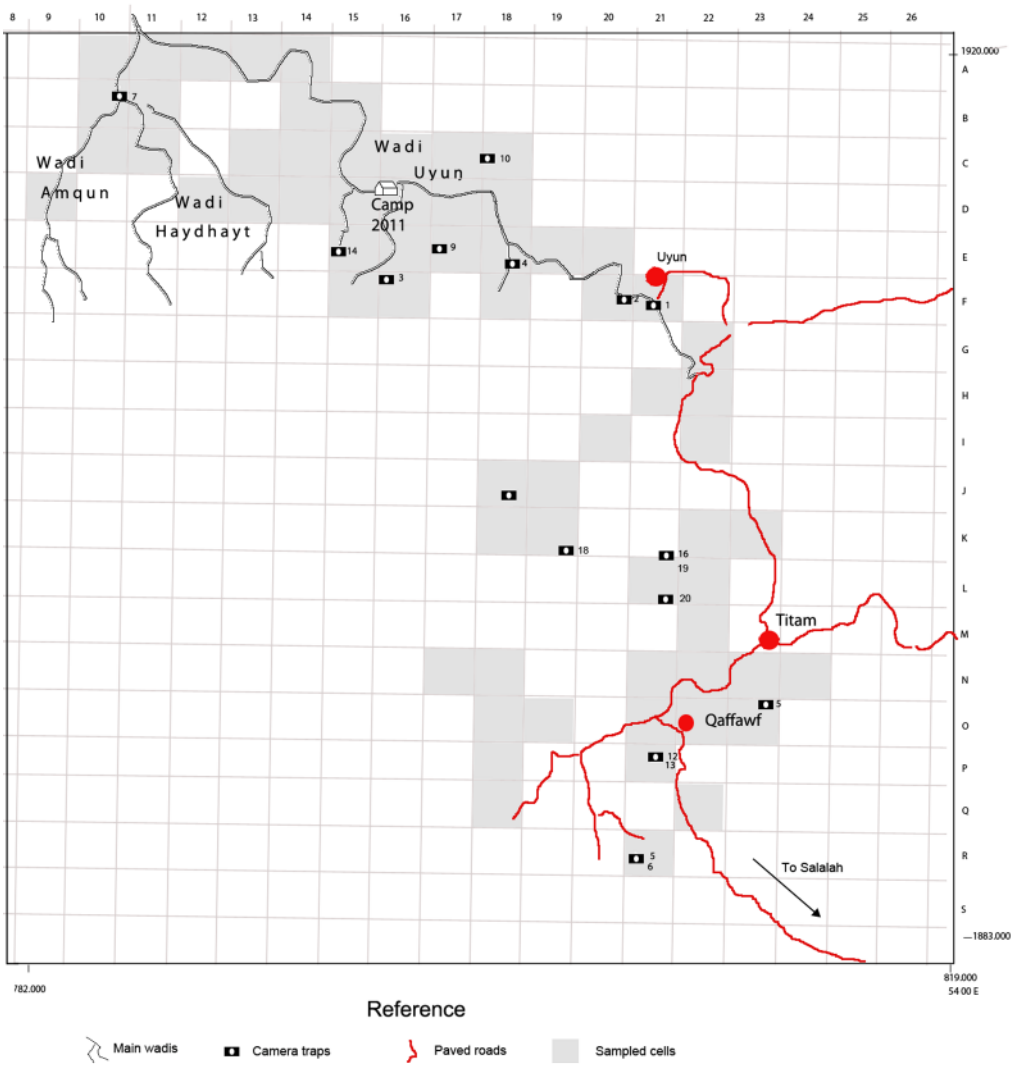

Figure 2.3a. Edited map of the study area, including the sixty six 2 x 2 km cells surveyed, with main wadi systems, expedition base, camera trap locations, and paved roads. Coordinates are in UTM datum WGS 84 and degrees and minutes. Cell coding is also shown, with numbers in the X axis and letters in the Y axis.

Leopard, wildcat, and fox were recorded at single cells exclusively by DNA analysis (Appendix 2). DNA analysis was also more efficient than other methods for caracal and wolf. Camera traps recorded species not recorded by other means, namely the honey badger, little spotted genet and mongoose in a single cell, and Blanford's fox in two cells (see Appendix 3 for pictures of species and Appendix 4 for details of camera trap data).

The maps below display the cells in which species with substantial quantitative information were found (for tabulated data see Appendix 5). Carcasses were not included as they can be carried by floods and are thus not representative of a given cell. Efficiency of methods in the way they contributed to detect species in cells varied for each species. Wolf and hyaena were recorded more widely by tracks; caracal by DNA analysis; gazelle by tracks, scats and sightings; ibex by tracks and scats; porcupine and hyrax by scats (Figs. 2.3b to 2.3h). Regarding aggregation and abundance, wolf was clearly restricted to the south of the study area (Fig. 2.3b), gazelle was detected mostly in the north (Fig. 2.3e) and ibex in the centre of the study area (Fig. 2.3f). No patterns of aggregation were found for the other species.

Table 2.3a. Comparative table of distribution of target species from years 2008 and 2011 (except those revealed through DNA analysis, not available for the 2008 period).

Species	Proportion of total cells with occurrence (n= number of cells in which species was recorded)		Difference in proportion of cells occupied
	2008 (n = 51) *	2011 (n = 66)	
Ungulates			
Gazelle	56.9 (n = 29)	68.2 (n = 45)	Increase by 11.3%
Ibex	52.9 (n = 27)	36.4 (n = 24)	Decrease by 16.5%
Hiracoidea			
Hyrax	58.8 (n = 30)	42.4 (n = 28)	Decrease by 16.4%
Rodentia			
Porcupine	—	57.6 (n = 38)	N/A
Carnivora			
Caracal	—	16.7 (n = 11)	N/A
Wolf	—	12.1 (n = 08)	N/A
Hyaena	31.4 (n = 16)	39.4 (n = 26)	Increase by 8%

*Mazzolli and Hammer (2008) Status of the Arabian leopard (*Panthera pardus nimr*) in Dhofar, Sultanate of Oman. Biosphere Expeditions, UK. Available via www.biosphere-expeditions.org/reports.

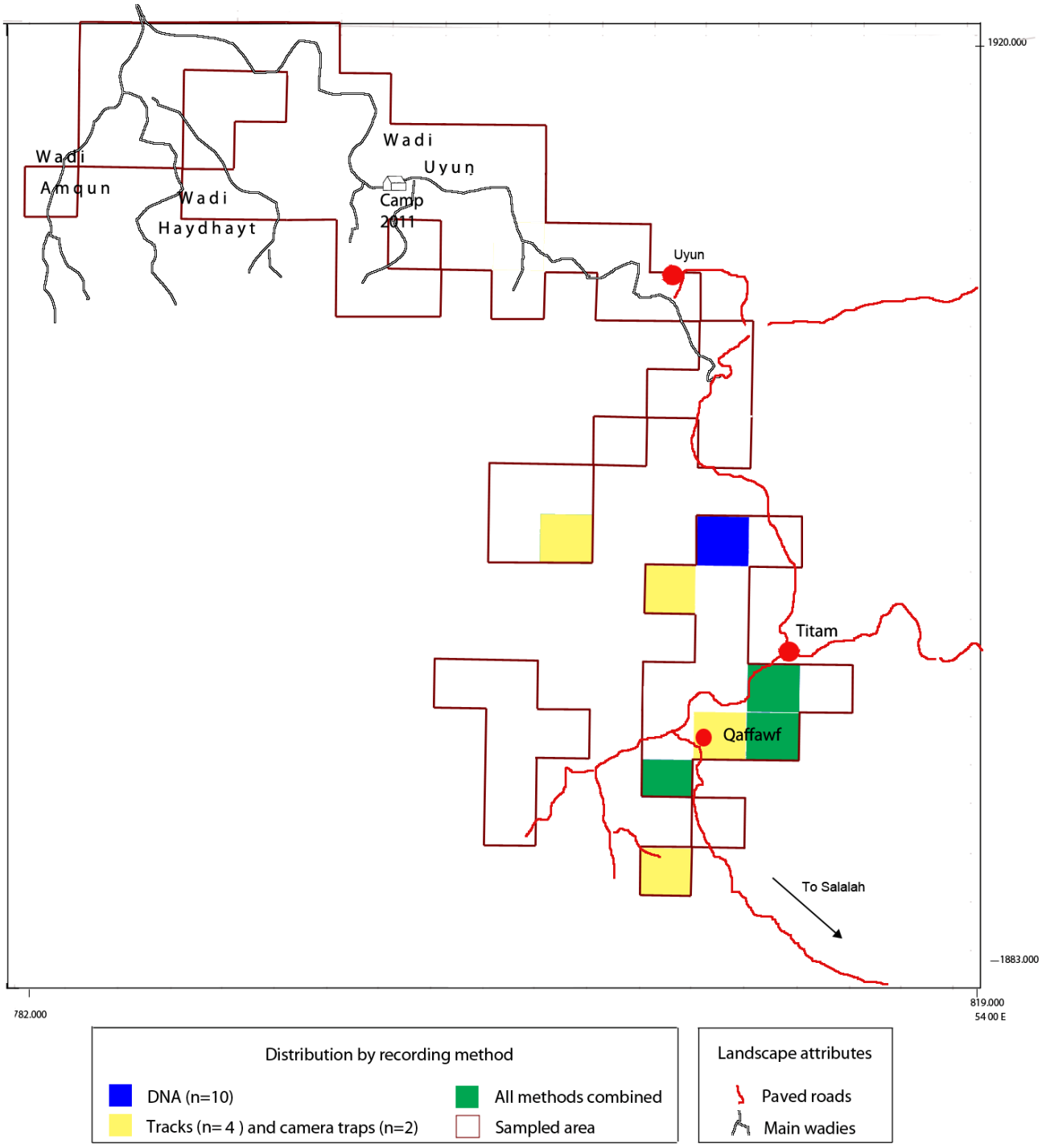

Figure 2.3b. Graphic showing wolf distribution. DNA scatology was found to be the best method for detection of wolves. Cells in which wolves were recorded are shown by method used: track identification, camera traps and DNA scatology. The number in the legend specifies frequency of records, not number of cells. All these methods may be considered reliable means to detect wolf presence, despite possible errors of track identification (see text). Wolf is clearly restricted to the southern portion of the sampled area.

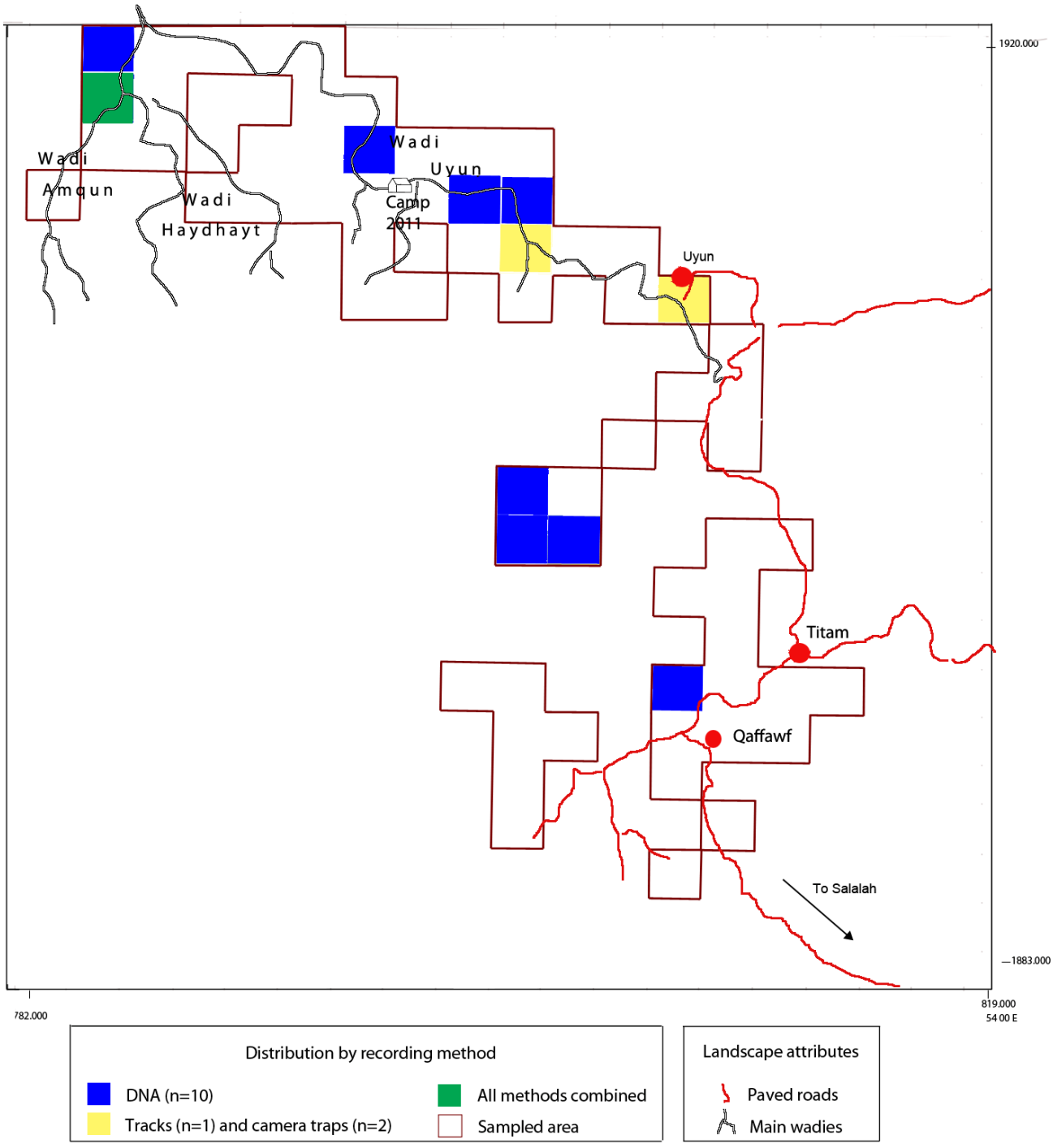

Figure 2.3c. Graphic showing caracal distribution. DNA scatology was found to be the best method for detection of caracal. Cells in which caracal were recorded are shown by method used: track identification, camera-traps and DNA scatology. The legend specifies frequency of records not number of cells. All these methods may be considered reliable means to detect caracal presence. There is no clear pattern of aggregation of cells for records of caracal.

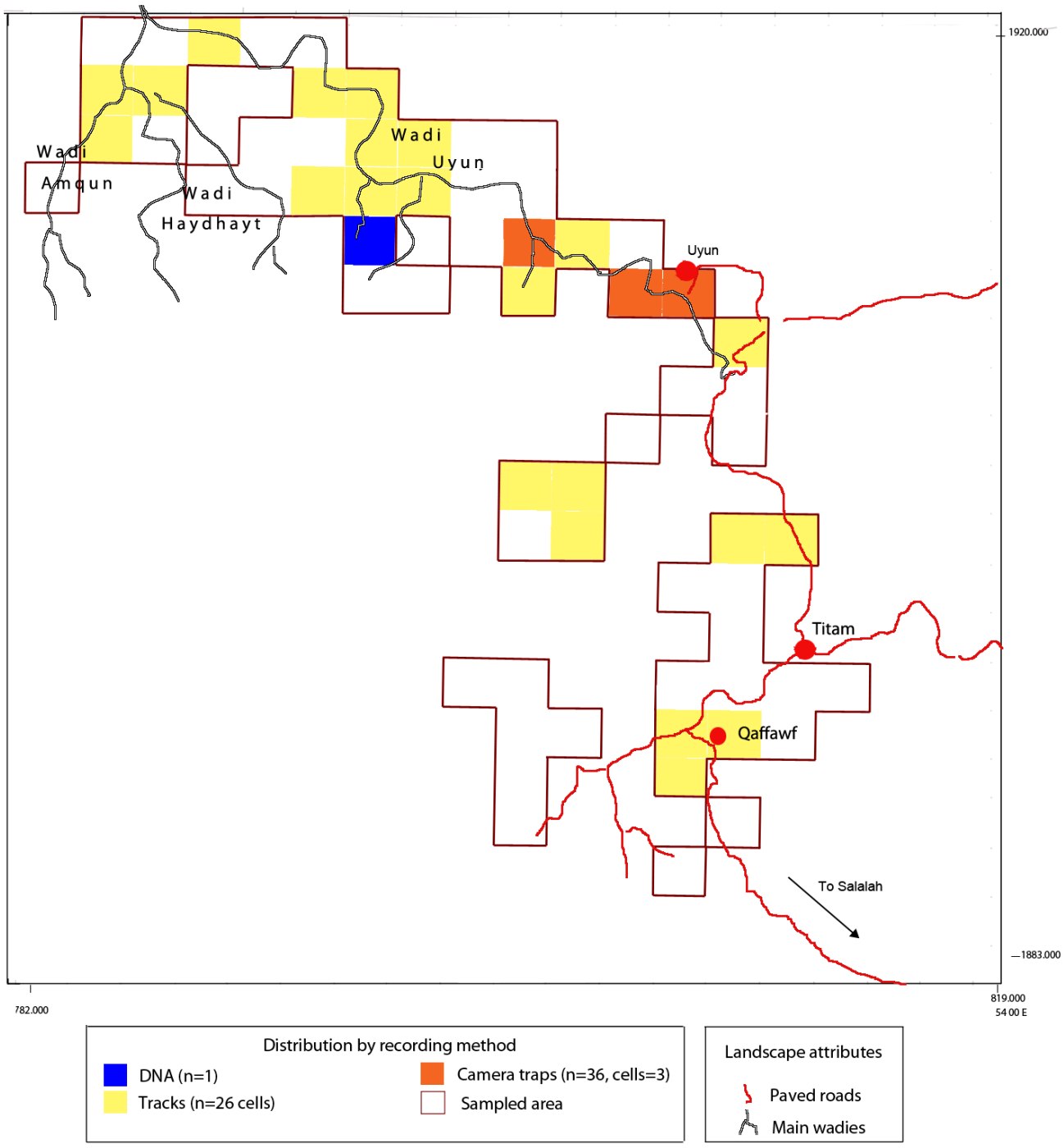

Figure 2.3d. Graphic showing hyaena distribution. Track identification was found to be the best method for detection of hyaenas. Camera traps had a high recording rate, but on few cells. Cells in which hyaenas were recorded are shown by method used: track identification, camera traps and DNA scatology. All these methods may be considered reliable means to detect hyaena presence. There is no clear pattern of aggregation of cells for records of hyaena.

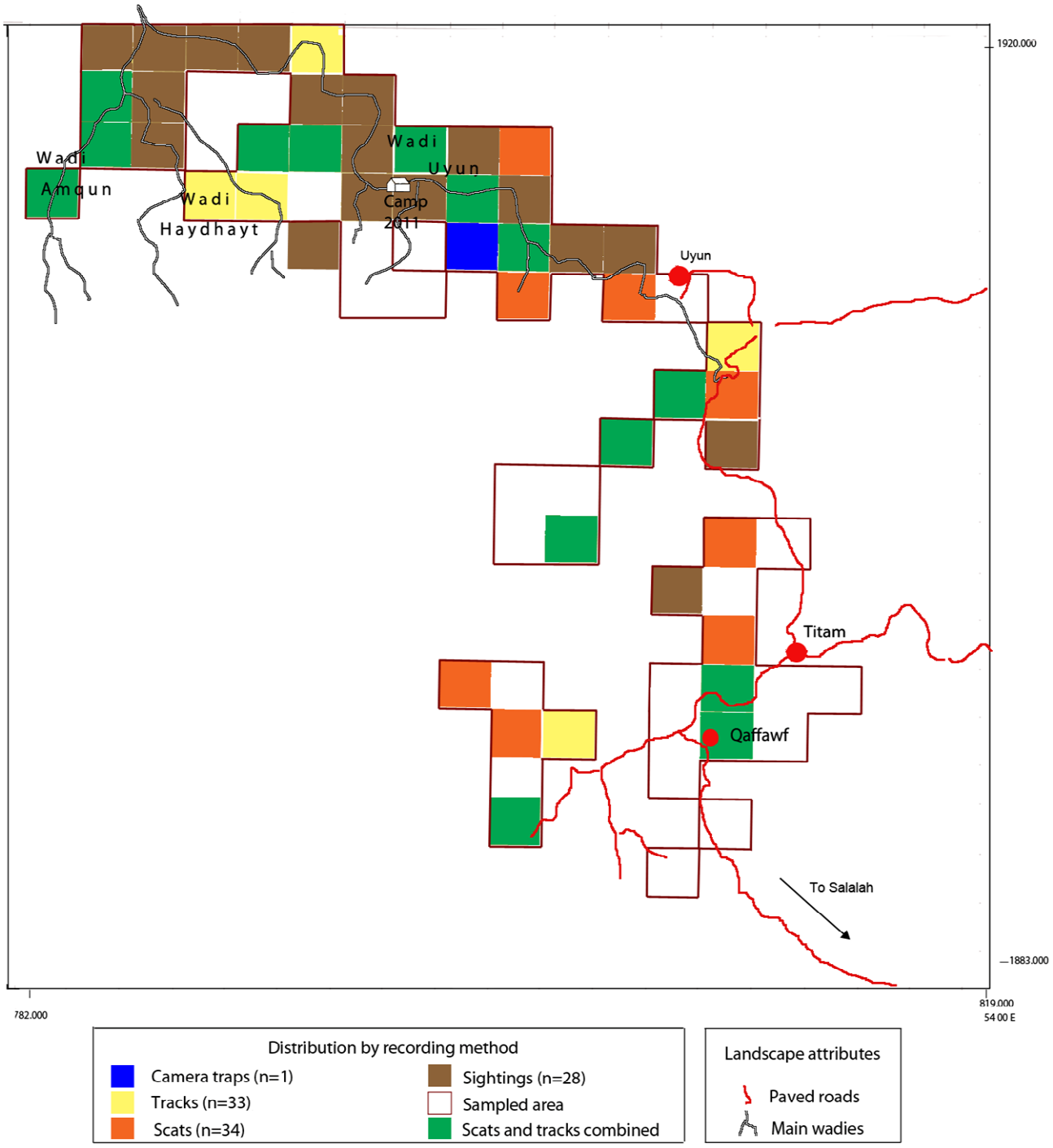

Figure 2.3e. Graphic showing gazelle distribution. Scats, tracks and sightings have all delivered high detection scores for gazelles. Cells in which gazelles were recorded are shown by method used: track identification, camera traps, sightings, and scats. The legend provides the number of cells sampled for each method. Sightings (for this particular species) are presumed to be a more precise method of recording and have been prioritised for display; cells in which sightings were recorded overlay those of other methods. Note that sightings are mostly restricted to the north of the sampled area and that there clearly are a larger number of cells with no records in the southern section of the sampled area. The presence of gazelles in the southern section is nonetheless corroborated by identification of tracks and scats in combination.

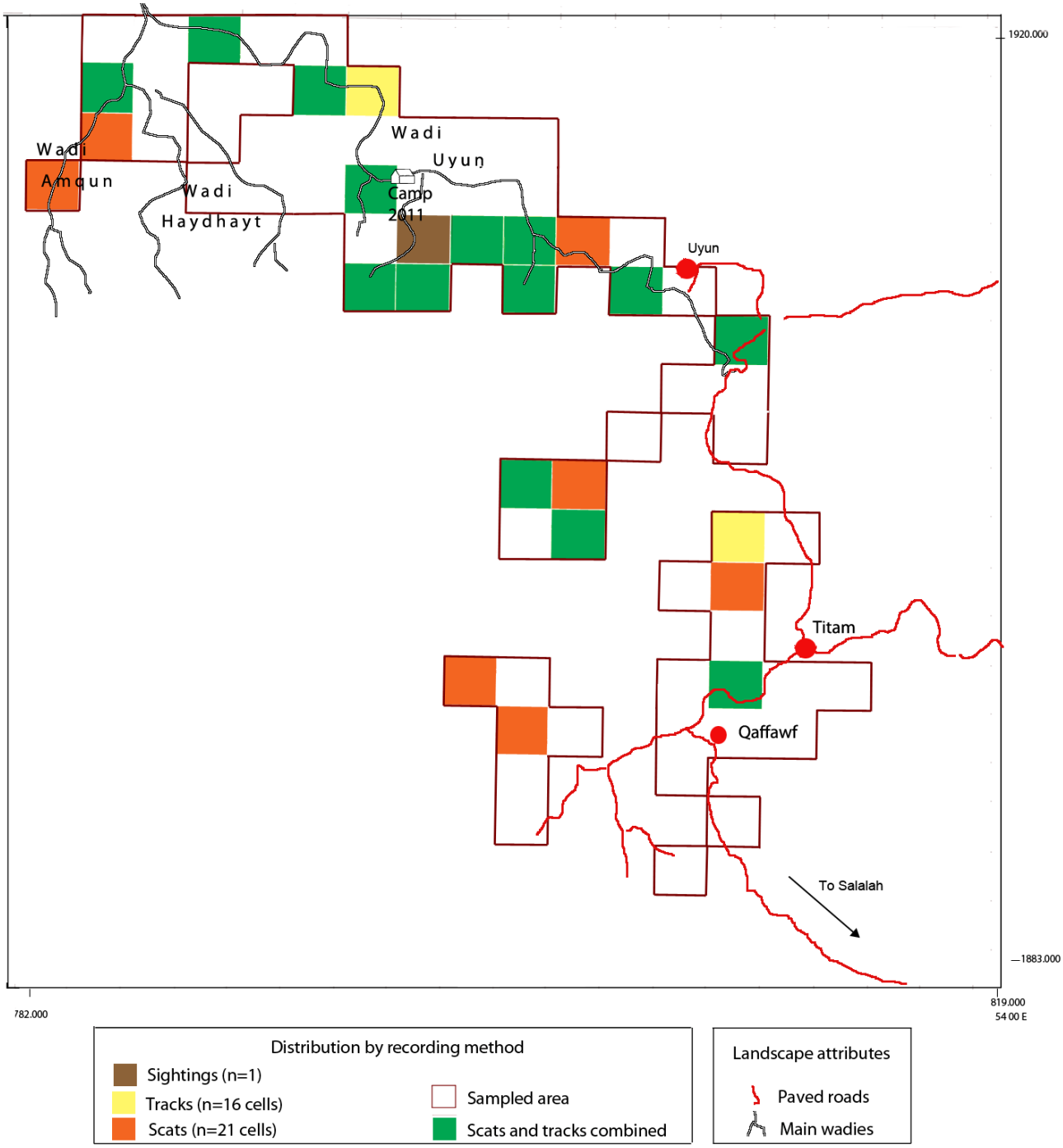

Figure 2.3f. Graphic showing ibex distribution. Scats and tracks delivered high detection scores for ibex and most cells show a combination of both. Cells in which ibex were recorded are shown by method used: track identification, camera traps, sightings, and scats. The legend provides the number of cells sampled for each method. Sightings were scored in just one cell and this was exclusive (no other method in this cell). Ibex locations seem to be aggregated around Wadi Uyun and north of Titam.

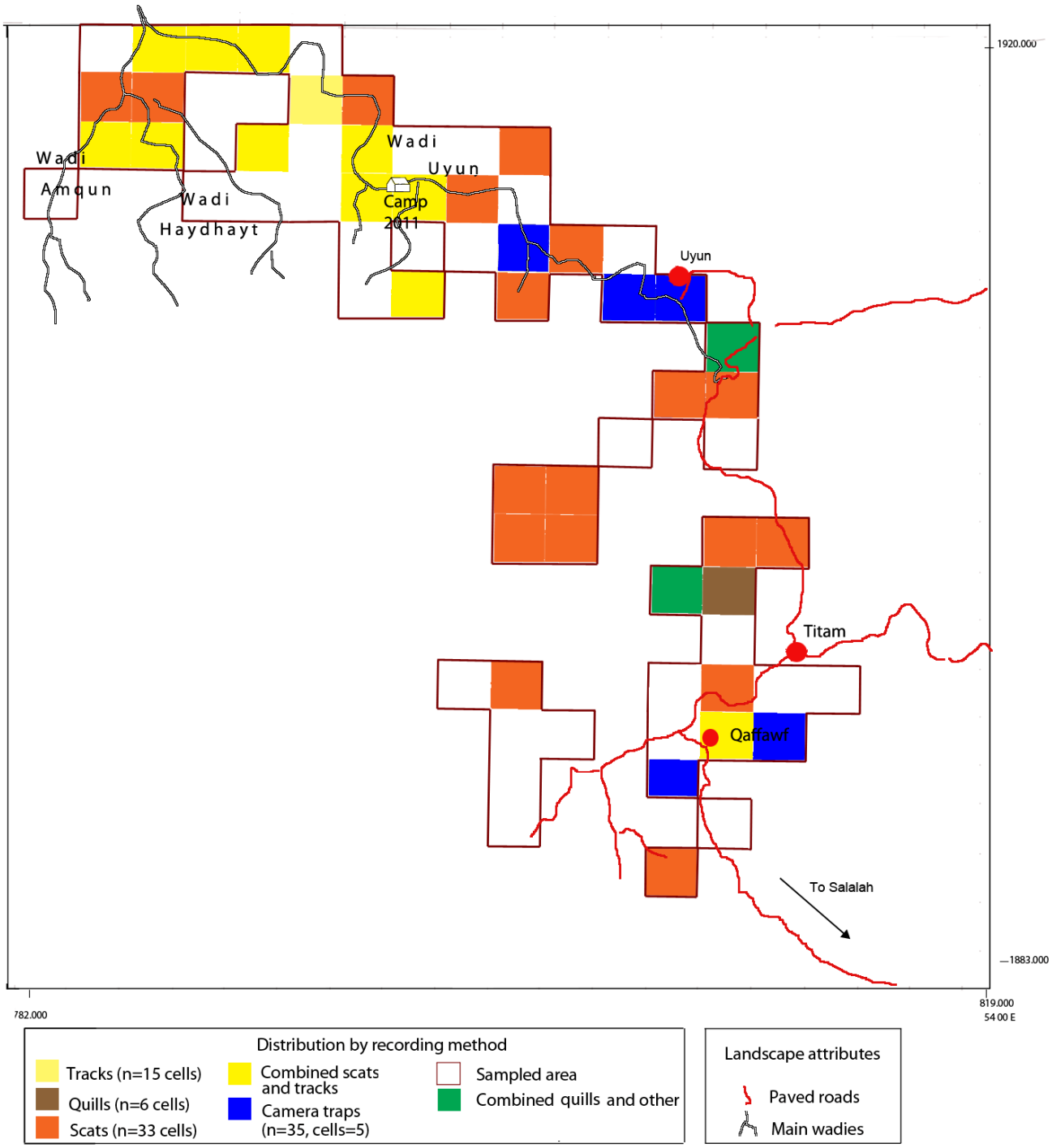

Figure 2.3g. Graphic showing porcupine distribution. Identification from scats was the best method of detection of porcupines over a wide area. Scats were found in all but one cell where tracks were also found. Camera traps had a high record rate, but in few cells. They are depicted in the map overlaying other methods. Cells in which porcupines were recorded are shown by method used: scat and track identification, and camera traps. All these methods may be considered reliable means to detect porcupine presence. There is no clear pattern of aggregation of cells for records of porcupine.

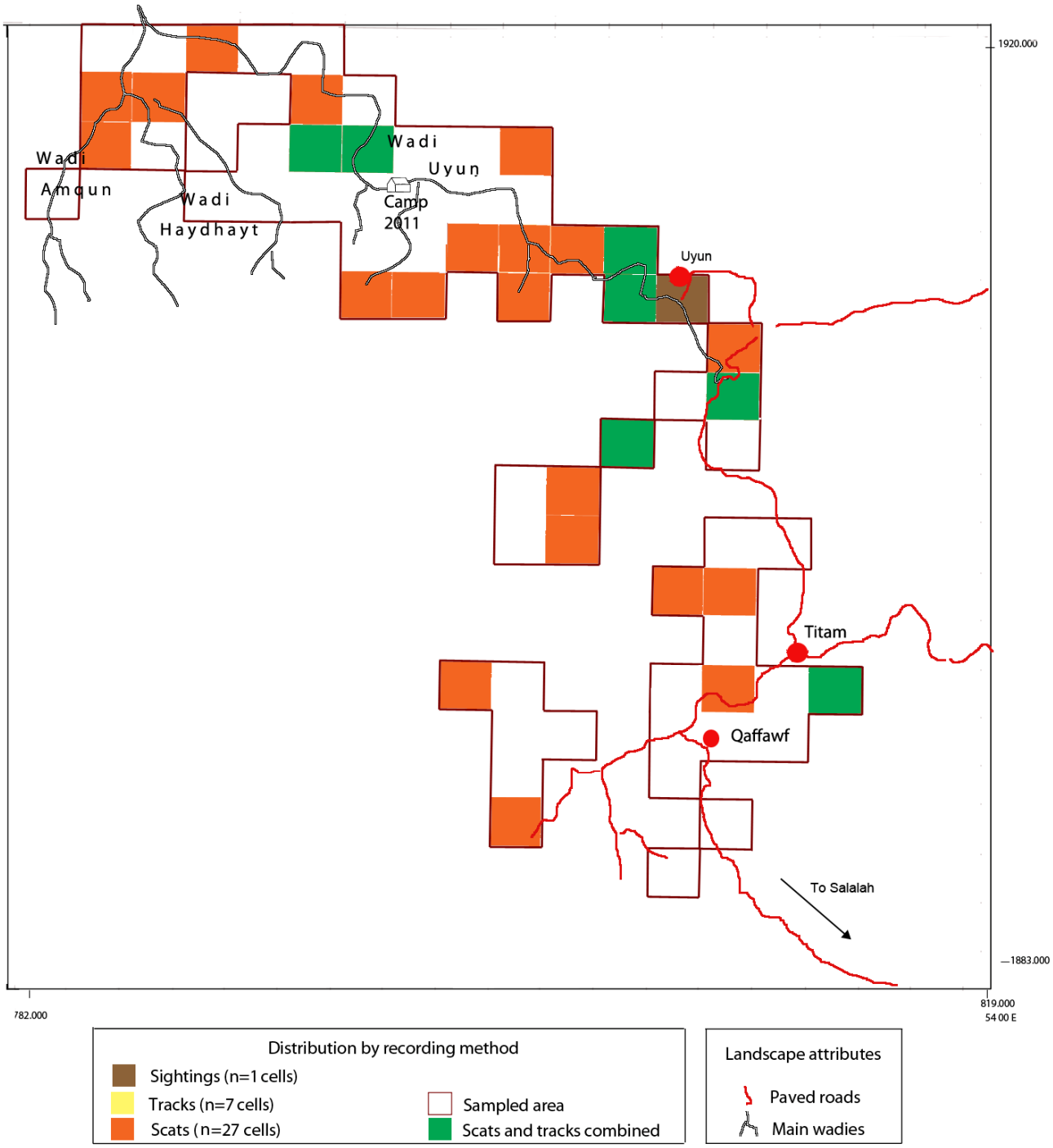

Figure 2.3h. Graphic showing hyrax distribution. Identification from scats was the best method for detection of hyrax over a wide area. Cells in which hyrax were recorded are shown by method used: scat and track identification and sighting. All these methods may be considered reliable means to detect hyrax presence. There is no clear pattern of aggregation of cells for records of hyrax.

Outreach activities and interviews

Nineteen activities were accomplished with the local community, of which 15 were interviews, two were talks at three schools, and two were talks at the offices of the governors of Hagaif and Jachnin districts. The activities reached 19 adult herders and farmers and 40 students at elementary school (Appendix 6). Aside from the activities near the study area, contacts were made in Salalah with officers of the Wildlife Department of the Ministry of Environment and Climate Affairs (Fig. 2.3.2a) and with lecturers and the Dean at the University of Salalah.

Figure 2.3.2a. Meeting between the scientist Marcelo Mazzolli (left), the Head of the Wildlife Department of Meca (Ministry of environment) Said Masalam Saed Al Mari (centre), and the expedition leader Paul o'Dowd (right) to report on expedition activities.

Results from interviews revealed that little or nothing is known of either the ranger's work in the area or the Leopard Survey Project, but most interviewees declared that they liked the leopard and all answered that they were aware of its protected status. Regarding leopard presence, answers were conflicting, on whether the species is declining or increasing. Livestock predation either from leopard or from other carnivores seemed not to be a major issue and leopards were mainly perceived as not to impact on game species either. No information of poaching of leopards or prey was obtained. There was a consensus of a severe grazing impact of livestock (Appendix 7).

DNA analysis results

DNA analysis was the best method for detecting wolf, caracal and leopard (see Fig. 2.3b – 2.3h above).

Leopard presence was confirmed by scat DNA analysis in a single location. The scat was located in the cell neighbouring the base camp cell. Intensive surveys were also conducted at the oasis of Uyun in cells 20 and 201F, with no results of leopard presence.

2.4. Discussion and conclusions

Monitoring programmes should address both the trends in wildlife populations over time and the heterogeneity of their distribution in the landscape.

True abundance or density cannot be estimated simply by counting numbers seen, this does not take into account detection probabilities. Such probabilities can only be obtained by standard line transect methodology or through capture-recapture data, none of which were feasible during this study, because they require a minimum number of animals sighted and time-consuming trapping and re-trapping of animals for individual identification.

Signs cannot unequivocally identify some mammals. This means that sampling for signs was not unrestricted for any species. In respect of identification of scats, carnivore scats identification by sight was considered to be misleading and was thus not encouraged. DNA analysis, for instance, has shown that an unacceptably high percentage of macroscopically-identified leopard scat turns out to be from other species (e.g. Arabian leopard 52% - Perez et al. 2006, snow leopard 54% - Janecka et al. 2008). Even the widely used identification of species using microscopic analysis of hair contained in scats often leads to erroneous identification (Harrison 2002, Vanstreels 2010). This does not, however, preclude conservative attempts to identify the presence of key species when no other methods are available, but limits must be established. Mazzolli (2009) has, with the help of local experts, performed the macroscopic identification of scats for leopard presence acknowledging the high level of uncertainty and thus the possibility of overestimating leopard presence. In a monitoring programme, however, it is desirable to employ methods that provide a greater precision.

In as much as carnivore scats *are not* suitable for species identifications, sacts of gazelle, ibex, hyrax, and porcupine *are* species-specific and as such yield information on presence or absence of these species. The higher amount of information recorded for target species as a result of using scats, however, does not necessarily imply that they are the most abundant or that there were not enough signs of other species. Indeed, issues related to the conditions to identify signs of other species may have hampered a broader scope. As mentioned, some species are more easily detected when present than others.

As with any animal able to move, the absence of records of a species in a certain cell does not necessarily mean that the species itself is absent. That is why resampling is required to provide a reliable scenario of species' occupancy (McKenzie et al. 2002). During the expedition, however, little resampling was actually done, because signs remained *in situ* for long periods before being erased (unlike in rainy or excessively windy areas) and because multiple simultaneous samplings (groups formed by several team members, spreading out in the wadis and over the ledges) compensated for the reduced resampling.

To be effective, it is also desirable that a monitoring programme uses a standard methodology that allows for comparison in both time and space. The Dhofar expeditions of 2008 and the current expeditions largely employed the same methodology and were thus comparable; with the exception that here DNA analysis was also employed. The most remarkable result from that comparison was the restricted range of the wolf to the southernmost tip of the study area and indications that gazelle was more abundant in the north. The apparent concentration of wolves in southern areas places the species in a more vulnerable position than that of other more widespread species that occupy a similar niche, such as the hyaena and caracal. All other species from which enough quantitative data were collected (hyaena, caracal, ibex, hyrax, porcupine) were widespread.

The results of the Dhofar expeditions during 2009-2010 differed in the way data were collected and analysed. In summary they found, with no tabulated data and using non-recommended macroscopic identification of carnivore scats, that the northernmost and southernmost zones were more biodiversity-rich and that the latter was better leopard habitat. The current study does not support that finding and no significant differences in the amount of leopard-like signs in the north and south were found.

The current study identified leopard presence in a single location, based on DNA analysis of scats, in the cell neighbouring the base camp cell, near a well. Surveys were also intensively done near another water source, the oasis of Uyun in cells 20 and 201F, with no results of leopard presence. That, combined with the fact that no other definitive proof of leopard presence was found, corroborates the findings of Mazzolli and Hammer (2008) and Mazzolli (2009) that leopard is uncommon in the area. This conclusion is further supported when the low or null rate of leopards verified from vestiges and/or camera traps found in the study area is compared with the higher rates obtained in the extreme west and east of the Dhofar mountains, by the Office of the Adviser for Conservation of the Environment – OACE (unpubl. data). Another study that allows comparison of relative abundance of leopards is that of Perez et al. (2006). These authors searched for scats near water bodies and also in locations where leopard had been previously recorded - from 112 of the collected scats that had DNA successfully amplified, 54 (48.2%) belonged to leopards, a more than tenfold higher rate than the 4.2% found in the current study.

The low occurrence of leopards is consistent with the reported low or null depredation rates. Livestock is common in the south of the study area and information collected from interviews suggests that losses to predation are rare. Thus the predation rate of leopard taking livestock should be low. This makes the low numbers of leopard intriguing. With healthy and widespread populations of wild prey, the only other obvious causes of leopard rareness are retaliation following livestock depredation and general persecution based on cultural myth-based prejudices.

Indeed Spalton (personal communication) and McGregor et al. (2011) reports that leopards are widely persecuted and cannot find sufficient sanctuary in the relatively open and exposed habitats that dominate the Dhofar mountains. Clearly more research work should be done to investigate the causes of low leopard numbers in the area, as well as social and educational work to raise environmental awareness, combat myth-based prejudices against the leopard and to find ways for leopards and humans to co-exist and to benefit from each other's presence.

Recommendations for further action (during expeditions and by other parties)

- Further expedition work and surveys.
- Standardise sampling and data analysis for all leopard studies in the region to allow and encourage comparisons across them.
- On-going training of local rangers and training in wildlife survey and monitoring methodology - to include collection and storage of possible leopard faeces for subsequent DNA analysis.
- Creating a forum involving local people, relevant government departments and tour operators to raise environmental awareness and address any conservation problems or human/wildlife conflict incidents.
- Livestock care and education programme to improve livestock management and encourage a reduction in livestock numbers. Excluding domestic livestock from most favourable habitats in the long term.
- Create a fund for leopard-related conservation in Oman under the following general headings: human-predator interactions, ecology and distribution of leopard, capacity-building.

2.5. Literature cited

Barrault, M. (1999) Regards Dhofar. Edition Michel Hetier. 112 pp.

Breitenmoser, U. & Breitenmoser-Würsten, C. (eds.). (2006) Cat News Special Edition n° 1. The IUCN Cat Specialist Group.

Graham, K., A. Beckerman and S Thirgood (2005) Human-predator-prey conflicts: ecological correlates, prey losses, and patterns of management. Biological Conservation 122:159-171.

Haag, T., A. Santos, C. Angelo, A. Srbek-Araujo, D. Sana, R. Morato, F. Salzano and E. Eizirik (2009) Development and testing of an optimized method for DNA-based identification of jaguar (*Panthera onca*) and puma (*Puma concolor*) faecal samples for use in ecological and genetic studies. Genetica 136:505-51.

Harrison, R. (2002) Evaluation of microscopic and macroscopic methods to identify field hair. Wildlife Society Bulletin 30 (2):412-419.

Harrison, D. and P. Bates (1991) Mammals of Arabia. 2nd Edition. Harrison Zoological Museum Publication, Sevenoaks.

Janecka, J., R. Jackson, Y. Zhang, D. Li, B. Munkhtsog, V. Buckley-Beason, W. Murphy (2008) Population monitoring of snow leopards using noninvasive genetics. Cat News 48:7-10.

Mackenzie, D. Nichols, J. Lachman, G. Droege, S. Royle, J. Langtimm (2002) Estimating site occupancy rates when detection probabilities are less than one. Ecology 83 (8):2248-2255.

MacKenzie, D.I. & J. Royle (2005) Designing occupancy studies: general advice and allocating survey effort. Journal of Applied Ecology 42: 1105-1114.

McGregor, T., H. Hikmani & M. Hammer (2011) Status of the Arabian leopard (*Panthera pardus nimr*) in Dhofar, Sultanate of Oman. Expedition report 2009/2010. Biosphere Expeditions, UK. Available via www.biosphere-expeditions.org/reports.

Mazzolli, M., M. Graipel, N. Dunstone (2002) Mountain lion depredation in southern Brazil. Biological Conservation 105: 43-51

Mazzolli, M. (2009) Arabian leopard *Panthera pardus nimr* status and habitat assessment in northwest Dhofar, Sultanate of Oman (Mammalia: Felidae). Zoology in the Middle East 47: 3-12.

Mazzolli, M. and M. Hammer (2008) Status of the Arabian leopard (*Panthera pardus nimr*) in Dhofar, Sultanate of Oman. Expedition report 2008. Biosphere Expeditions, UK. Available via www.biosphere-expeditions.org/reports.

Perez, I., E. Geffen, O. Mokady (2006) Critically Endangered Arabian leopards *Panthera pardus nimr* in Israel: estimating population parameters using molecular scatology Oryx 40 (3): 295-301.

Spalton, J. and H. al Hikmani (2006) The leopard in the Arabian Peninsula – distribution and subspecies status. Cat News Special Issue No. 1: 4-8.

Spalton, J., H. al Hikmani, H. Willis, A. Bait Said (2006a) Critically endangered Arabian leopards *Panthera pardus nimr* persist in the Jabal Samhan Nature Reserve, Oman. Oryx 40 (3): 287-294.

Spalton, J., H. al Hikmani, M. Jahdhami, A. Ibrahim, A. Bait Said, D. Willis (2006b) Status of the Arabian leopard *Panthera pardus nimr* in the Sultanate of Oman. Cat News Special Issue No. 1: 26-32.

Vanstreels, R., F. Ramalho, C. Adania (2010) Microestrutura de pêlos-guarda de felídeos brasileiros: considerações para a identificação de espécies. Biota Neotropical 10 (1): 333-337.

Appendix

Appendix 1. Species recorded during the 2011 expedition.

Common Name	Latin name	Sighting	Sign	Camera trap	Bones and carcasses	DNA analysis
Arabian leopard	*Panthera pardus nimr*	—	—	—	—	x
Caracal	*Caracal caracal*	—	x	x	—	x
Gordon's wildcat	*Felis silvestris gordoni*	—	—	—	—	x
Striped hyaena	*Hyaena hynaea*	—	x	x	—	x
Arabian wolf	*Canis lupus arabs*	—	x	x	x	x
Arabian red fox	*Vulpes vulpes arabica*	—	x	—	x	—
Blanford's fox	*Vulpes cana*	—	—	x	—	—
Honey badger	*Mellivora capensis*	—	—	x	—	—
Small spotted genet	*Genetta genetta*	—	—	x	—	—
White-tailed mongoose	*Ichneumia albicauda*	—	—	—	—	—
Arabian gazelle	*Gazelle gazella cora*	x	x	x	x	—
Nubian ibex	*Capra nubiana*	—	x	—	x	—
Rock hyrax	*Procavia capensis*	x	x	x	x	—
Cape hare	*Lepus capensis*	—	x	—	—	—
Indian crested porcupine	*Hystrix indica*	—	x	x	x	—
Hedgehog	*Paraechinus aethiopicus and P. hypomelas*	x	—	—	—	—

Appendix 2. Results of DNA identification from scats. Dash (—) = not available. A single leopard scat was found at coordinates X=794834 Y=1916139. Datum WGS 84.

Sample number	Label	Date	Cell	Species
01	01	—	23O	*Canis lupus*
02	02	—	23O	*Canis lupus*
03	03	28/02/2011	10B	*Caracal caracal*
04	04	23/02/2011	19K	*Caracal caracal*
05	05	16/02/2011	22K	*Canis lupus*
06	06	01/03/2011	18D	*Caracal caracal*
07	09	24/02/2011	15C	*Panthera pardus*
08	11	28/02/2011	10B	*Caracal caracal*
09	12	23/02/2011	18J	*Caracal caracal*
10	14	24/02/2011	21L	*Vulpes* sp.
11	15	15/02/2011	15E	*Hyaena hyaena*
12	17	16/02/2011	23N	*Canis lupus*
13	18	15/02/2011	17D	*Caracal caracal*
14	20	—	21N	*Caracal caracal*
15	21	—	10A	*Caracal caracal*
16	22	16/02/2011	21P	*Canis lupus*
17	23	24/02/2011	21P	*Canis lupus*
18	24	24/02/2011	15C	*Caracal caracal*
19	28	—	21P	*Canis lupus*
20	30	16/02/2011	21P	*Canis lupus*
21	31	—	21P	*Canis lupus*
22	32	16/02/2011	23O	*Canis lupus*
23	33	01/03/2011	18D	*Felis silvestris*
24	34	23/02/2011	18K	*Caracal caracal*

Appendix 3 Sample of mammals camera-trapped during the 2011 expedition.

Caracal

Porcupine

Striped hyaena

Arabian wolf

Juvenile Arabian ibex

Hyrax

Honey badger

Blanford's fox

Small spotted genet

Appendix 4. Camera trap locations, sampling effort, and results.

ID	Date installed	Cell	X (east) coordinate	Y (north) coordinate	Date removed	Trap nights	Species (n)
1	08/02/11	21F	0806879	1909673	02/03/11	22	Hyaena (6), porcupine (5), caracal (1), mongoose (1)
2	08/02/11	20F	0805676	1909910	02/03/11	22	Hyaena (13), porcupine (12)
3	09/02/11	16F	0796330	1909996	11/02/11	02	—
3	11/02/11	16F	0796306	1910653	27/02/11	16	—
4	09/02/11	18E	0801269	1911415	27/02/11	18	Hyaena (1), Porcupine (5), caracal (1), Blanford's fox (1)
5	09/02/11	21R	0806254	1886007	27/02/11	18	—
6	10/02/11	21R	0806771	1886110	27/02/11	27	Hyrax (17), honey badger (3), wolf (1)
7	10/02/11	10B	0785578	1918502	28/02/11	18	—
8	09/02/11	16F	0796265	1911001	11/02/11	03	—
9	15/02/11	17E	0798368	1912064	28/02/11	13	Gazelle (1)
10	15/02/11	18C	0799351	1914080	01/03/11	14	—
11	14/02/11	22N	0809426	1893087	28/02/11	14	—
12	16/02/11	21P	0807230	1890355	01/03/11	13	Porcupine (12), little spotted genet (4)
13	16/02/11	21P	0807258	1890439	01/03/11	13	—
14	15/02/11	15E	0794354	1911828	02/03/11	15	—
15	16/02/11	23O	0811547	1892739	02/03/11	14	Porcupine (1), wolf (1)
16	16/02/11	21L	0807575	1899030	24/02/11	8	—
16	24/2/11	21L	0807907	1898267	01/03/11	5	—
17	23/2/11	19J	0802121	1902064	02/03/11	7	—
18	23/2/11	19K	0802427	1900691	01/03/11	6	—
19	24/2/11	21L	0808221	1898192	01/03/11	5	Blanford's fox (1)
20	24/2/11	21L	0807914	1897371	01/03/11	5	—
		Total camera trap nights				**278**	**Number of species = 9**

Appendix 5. Cells in which target species were found. Target species were those mammals that represented rare and resource-demanding species, leopard prey species, or those that were recorded in sufficient numbers for quantitative analysis. Cells recorded by DNA not included, please refer to appendix 2.

Species	Cells	Type of record
Caracal	10B/18E	Track, camera trap
Hyrax	21F/18F/15D/15C/20F/19E/ 14B/15-16F/11B/11A/10B/ 20I/22G/22H /17D/17E//17N/18C/18E/18J/18K/18Q/19J/19K/21L/22L/22N/24N/14C	Track, scat, camera trap, carcass
Gazelle	18E/15D/15C/20F/15B/19E/14B/10B/11B/11C/10C/9D/12A/13A/11A/22G/14C/ 13C/20I/22H/21H/17D/17E/16D/ 22K/10A/12E/13D/14A/18C/18F/21L/17N/18Q/19K/19O/22N/ 22O	Track, camera trap
Hyaena	21F/20F/18F/15C/14D/15D/15B/19E/14B/10-11B/10C/11A/18Q/ /23K/15E/16D/22K/17N/18C/18J/19J/19K/21R/24N/ 23O/22Q/21P	Track, camera trap
Ibex	18E/20F/15B/19E/14B/15-16F/10C/9D/10B /12A/22G/17E/ /21O/15E/15D/22K/ 15C/17N/18F/18J/18K/18N/19J/19K/18O/22L/22N	Track, scat
Leopard	—	DNA analysis of fecal samples
Porcupine	21F/20F/18F/15C/15D/15B/20E/19E/14B/21R/15-16F/10-11B/11C/10C/12A/13A/11A/13C/22G/22H/21H/17D/18Q/23K/22K/16D /10A/10B/18C/18E/18J/18N/19J/19K/21L/22L/22N/22O/23O/21P	Track, scat, quills, camera trap
Wolf	23O/21P/19K/ 21L/22O/23N/21R	Track, camera trap

Appendix 6. Summary of outreach activities and interviews with local communities.

Date	Location	Contact person	Activity (interview, talk, meeting)	Beneficiary/ profile	Number and status of beneficiary
15/2/11	Titam		Talk	Two schools	40 students
24/2/11	Titam		Interview	Two herdsmen	2
24/2/11	Titam		Interview	Farmer with livestock	1
24/2/11	Qaftaut		Interview	Camel herder	1
27/2/11	East of Ayoon, Kismin village	Principle and teachers	Talk, handing out brochures	Mixed primary school	Only talk to adults (6)
27/2/11	Village Hagaif	Governor of Hagaif district	Talk at his office	governor	1 person
27/2/11	Village Jachnin	Governor of Jachnin	Talk at his office	Governor, 2 elderly sheiks, 2 secretary of governors office, 1 young man	6 people
27/2/11	Outside Hagaif village near road		Interview	Camel herder	1 person
27/2/11	5 km from Ayoon village near road		Interview	Camel herder	1 person
27/2/11	Qaftoat		Interview	Man with some livestock (main profession not herder)	1 person
28/2/11	Aruqum	Farmer's wife	Interview	Farmers family, Diwans rep.'s	3 adults, 1 child
28/2/11	Thila		Interview	Two farmers	2 persons
28/2/11	Ariqun/Araqun		Interview	Farmer with livestock	1 woman
28/2/11	Araqun watertank		Interview	Farmer with livestock	1 man
28/2/11	Titam/ Thub		Interview	Farmer with livestock	1 man
28/2/11	Aqbat tawq		Interview	Young man	1 person (+children)
1/3/11	Titam		Interview	1 elderly man (former military now herder)	1
1/3/11	Jebel Safa		Interview	1 farmer	1
1/3/11	near Qaftaut		Interview	1 farmer	1

Appendix 7. Tabulated interview data. Total interviews with completed datasheets (n=15). The totals in each item does not always sum to the tota number of interviewees, as often responses are unavailable. The item 'leopard presence' may have more than one input from the same interviewee, 'not present' and 'present <10 years'.

Item	Interview results	Item	Interview results	Item	Interview results
Ranger's work		Leopard perception		Leopard impact on game species	
Known	1	*Dislike*	2	*Significant*	1
Unknown	10	*Like*	7	*Occurs*	0
Leopard survey project *		*Indifferent*	4	*None*	5
Known	0	Leopard attack on livestock		Poaching of leopard	
Unknown	2	*Significant*	0	*Significant*	0
Leopard presence		*Occurs*	0	*Occurs*	0
Not present	4	*None*	5	*None*	2
Recent (<5 years)	5	Livestock losses to other causes		*Not available*	11
Old (> 10 years)	4	*Significant*	0	Poaching of prey	
Don't know	4	*Occurs*	3	*Significant*	0
Leopard population trend		*None*	4	*Occurs*	0
Increasing/stable	2	*Not available*	2	*None*	3
Declining	1	Leopard protection status		*Not available*	10
Don't know	5	*Known*	8	*Livestock grazing impact*	
Not available	5	*Unknown*	0	*Severe*	7
				Moderate/low	0

* This item was not in the questionnaire, but it was mentioned once. It should be incorporated in the next questionnaires.

Appendix 8. Bird inventory generated by the expedition.

BIRD LIST OMAN

Common name	Latin name	2009	2010	2011
Afican scops owl	*Otus senegalensis*	x		
African paradise flycatcher	*Terpsiphone viridis*			x
African rock bunting	*Emberiza tahapisi*			x
African rock martin	*Ptyonoprogne fuligula*	x	x	
Arabian (Masked) babbler	*Lanius nubicus*	x	x	
Arabian babbler	*Turdoides squamiceps*	x	x	x
Arabian partridge	*Alectoris melancocephala*	x	x	x
Arabian warbler	*Sylvia nana*	x	x	
Arabian wheatear	*Oenanthe lugentoides*	x	x	x
Asian brown flycatcher	*Muscicapa davurica*			x
Barn swallow	*Hirundia rustica*	x	x	
Black (common) redstart	*Phoenicurus erythronotus*	x	x	
Blue rock (cinnamon-breasted) thrush	*Monticola solitaris*	x		
Bonelli's eagle	*Aquila fasciatus*		x	x
Brown neck crow	*Corvus ruficolis*			x
Bruce's green pigeon	*Treron waalia*		x	
Chestnut-bellied sandgrouse	*Pterocles exustus*		x	
Collared dove	*Sleptoplia decaorto*			x
Common redstart	*Phoenicurus phoenicurus*			x
Common swift	*Apus apus*	x	x	
Cream-coloured courser	*Cursorius cursor*		x	
Crested lark	*Galerida cristata*	x	x	x
Daurian shrike	*Lanus isabellinus*			x
Desert lark	*Galerida deserti*	x	x	
Desert lesser whitethroat	*Sylvia curruca minula*	x	x	
Desert warbler	*Ammomanes deserti*			x
Desert wheatear	*Oenanthe deserti*	x	x	
Dhofar swift	*Apus sp*	x	x	
Eastern Imperial eagle	*Aquila heliaca*	x		
Egyptian vulture	*Neophron percnopterus*	x	x	x
Eurasian coot	*Fulica atra*	x	x	
European roller	*Coracias garrulus*	x	x	
Fan-tailed raven	*Corvus rrhipidurus*	x	x	x
Fork tailed swift	*Apus pacificus*			x
Gadwall	*Anas strepera*		x	
Glossy ibis (Salalah)	*Plegadis falcinellus*			x
Graceful prinia	*Prinia gracilis*	x	x	
Greater spotted eagle	*Aquila Clanga*	x		
Grey heron	*Ardea cinerea*		x	
Grey wagtail	*Motacilla cinerea*	x	x	
Grey-headed kingfisher	*Halcyon leucocephala*		x	

BIRD LIST OMAN

Common name	Latin name	2009	2010	2011
House (striolated) bunting	*Emberiza striolata*	x	x	
House crow	*Corvus spleiders*	x		x
Hume's tawny owl	*Strix butleri*	x	x	
Isabelline wheatear	*Oenanthe isabellina*	x	x	
Kestrel	*Falco tinnunculus*	x	x	x
Laughing dove	*Steptopelia senegalensis*	x	x	x
Lesser kestrel	*Falco naumanni*		x	
Lichenstein's sandgrouse	*Pterocles lichtensteinii*	x	x	x
Little green bee-eater	*Meropos orientalis*	x	x	x
Long-billed pipit	*Anthu similis*	x	x	
Long-legged buzzard	*Buteo rufinus*	x		x
Masked (Steppe grey) shrike	*Lanius (m.) pallidirostris*		x	
Moorhen coot	*Gallinurla chloroptus*			x
Ruppells Weaver	*Ploceus galbula*			x
Northern (hooded) wheatear	*Oenanthe oenanthe*		?	x
Palestine sunbird	*Nectarinia osea*	x	x	x
Red-rumped swallow	*Hirundo daurica*	x		
Richard's pipit	*Anthus richardi*	x	x	
Ring-necked (rose-winged) parakeet	*Psittacula krameri*	x	x	
Rock dove	*Columba livia*	x	x	x
Rose-coloured starling	*Sturnus roseus*		x	
Rufous-tailed rock thrush	*Monticola saxatilis*	x		
Saker falcon	*Falco cherrug*		x	
Sand partridge	*Ammoperdix heyi*	x	x	x
Scrub warbler	*Scotocerca inquieta*	x	x	
Shining sunbird	*Nectarinia habessinica*	x	x	
Short toed eagle	*Circaetus gallicus*			x
Southern grey shrike	*Lanius meridionalis*	x	x	x
Spotted eagle owl	*Bubo (africanus) milesi*	x	x	
Steppe eagle	*Aquila nipalensis*		x	x
Stonechat (African stonechat? - S. felix)	*Saxicola torqauta*	x	x	
Tawny pipit	*Anthus campestris*	x	x	
Trsitam's grackle (starling)	*Onychognathus tristramii*	x	x	x
Variable wheatear	*Oenanthe picata*			x
Verreaux's eagle	*Aquila verreauxii*	x	x	
White pectacle bulbul	*Pycnonotus xanthopygos*			x
White wagtail	*Mutacilla alba*			x
Citrine wagtail	*Motacilla citreola*	x	x	x
Yellow-vented bulbul	*Pycnonotus xanthopygos*	x	x	x

Appendix 9: Interview datasheet.

GUIDELINES FOR RECORDING INTERVIEWS
OMAN

Objectives of interviews

To learn from local community on the main following topics:

1. Where leopards are present now, and where they were present in the past (possible change in distribution);
2. Attacks of leopard to livestock (goats, camels, etc) now and in the past;
3. Where leopard are most often seen now and where there are more attacks to livestock – If leopards have attacked recently you can plan to visit this location;

Guidelines for Team members

You will be visiting local people to find out about their attitudes to and information on Arabian leopards and other wildlife. These interviews will be conducted in Arabic and will be discussed with you. Give time to the Arabic interviewer to get acquainted and introduce the subject to the interviewee. He should soon get you updated on the conversation, as he has been briefed to do. In practice, role of the team member is to make sure that all topics on this sheet are covered and all questions asked as far as possible. In a broader sense, this component of the project would not be in execution without your presence.

1. Be relaxed, friendly, chatty.
2. Take pictures only after asking for permission and then only a few.
3. Keep the datasheet out of sight as much as possible.
4. You can glance at the datasheet or record the questions in your notebook beforehand to make sure they are all covered.
5. Immediately after the interview and out of sight of the interviewee, discuss the datasheet and record the answers, using judgment.
6. Discuss the datasheet in the evening with scientific staff as part of filling in datasheet activity

Guidelines for the Ranger and OCE staff

It is recommended that you introduce yourself and the team members appropriately. This procedure is to avoid the community to consider your as guide and the group as tourists, which is not true. Make sure the local guide, if present, also understand that the **team members are research volunteers working in cooperation with the Diwan of Royal Court and Ministry of Environment & Climate Affairs**, in the Leopard Survey Project. Introduce yourself as Ranger of the Ministry of Environment or an officer of the OACE, as appropriate. You should avoid such sentences as '<u>they</u> want to know about …', the best way to communicate is to say '<u>WE</u> are interested to know about the leopard, as we are in the condition as researcher for the Leopard Survey of the OACE…'. Failure to do so may compromise the interview, as the community will perceive the Biosphere Expedition's team as foreign tourists and may ask for rewards.

Guidelines for the local guide

The Diwan of Royal Court, the Ministry of Environment & Climate Affairs, and Biosphere Expeditions are interested in the leopard because it is disappearing fast. If we do not help protect it, the desert border and mountains will be emptied, there will be no more leopards in the wild. By helping the leopard, you'll be helping your community.

You are very important for this research because people from your community will trust you information that would not to visitors. We need to know as much as we can about the presence of the leopard in the past and where it is know to live now. If the leopard is causing damage to livestock (goats, camels) we need to know to help the leopard and the herders.

DATASHEET: RECORDING INTERVIEWS
OMAN

INTERVIEW CONDUCTED BY: **DATE OF THE INTERVIEW:**

PERSONAL INFORMATION ABOUT THE INTERVIEWEE

Sex:

Age:

Place of residence (name of community):

Place of birth (region):

Occupation:

If you are a livestock owner/raiser, what kind of animals do you have?
Camels Goats Cows Horses Other

INFORMATION ABOUT ARABIAN LEOPARDS AND OTHER WILDLIFE

Are there leopards near this area? If there are, when did you have a last evidence?
□ More than 10 year ago □ Between 5 and 10 years ago □ Less than 5 years ago

Where did you find evidence of the leopard (Wadi, Region?) _____

If you have a herd, where do you leave it (Wadi, Region?) _____
(You should insert a general coordinate after the interview) Coordinates: _____

If you have a herd, there are leopards near it? Yes _____ No _____

Livestock losses to <u>leopards</u> (fill number of animals that have been taken)

	Loss this year	Loss last year	Total herd size	Number of herders involved (single herd or multiple herd)	Unit price in OMR
Camel					
Goat					
Cattle					

Livestock losses to <u>other animals</u> (hyaenas, wolves, dogs)

	Loss this year	Loss last year	Total herd size	Number of herders involved (single herd or multiple herd)	Unit price in OMR
Camel					
Goat					
Cattle					

DATASHEET: RECORDING INTERVIEWS
OMAN

Livestock losses to <u>other causes</u> (disease, fall from cliff, snake bite, theft, drought)

	Loss this year	Loss last year	Total herd size	Number of herders involved (single herd or multiple herd)	Unit price in OMR
Camel					
Goat					
Cattle					

YOUR OPINION ON THE LEOPARD

Which of the following statements best describes your feelings towards Arabian leopards?

Strongly dislike Dislike Indifferent Like Strongly like

The presence of Arabian leopards for you is
A good thing A bad thing You are indifferent You are scared

If Arabian leopards attracted more tourists to the region, this would be

A good thing A bad thing You are indifferent

Are Arabian leopards protected in Oman? Yes ____ No _____

	Strongly disagree	Dis-agree	Neutral	Agree	Strongly agree
Arabian leopards have a considerable impact on large game (gazelle, ibex, etc)					
Arabian leopards have a considerable impact on small game (hyrax, hedgehogs, etc)					
Arabian leopard attack humans					
In regions where Arabian leopards live in close proximity to livestock, they feed primarily on domestic animals					
We already have enough Arabian leopards in the region					

Comments (record any other useful/interesting information here)

Appendix 10: Expedition leader's diary

27 January

Welcome to the 2011 Oman expedition diary. Just a quick one from us at Biosphere Expeditions to say that staff have started to arrive in Muscat, we have picked up four shiny new Land Rovers, retrieved our equipment from storage and are now in full swing getting the expedition prepared, first in Muscat and then later in Salalah and Dhofar, Insha'Allah.

"Insha'Allah", by the way, is a phrase you are about to become very familiar with. I usually introduce new expeditioners to this phrase right from the start, so I'll do it again in this first diary entry: Insha'Allah translates roughly as... 'If Allah wills it' and is a marvelously useful term of complete fatalism and one which has no direct English equivalent. The nearest thing would probably be '...but on the other hand I might get hit by a number 73 bus tomorrow' - uttered in tones of sodden dejection by a clinical depressive with a strong Solihull accent.

So far so good. I'll e-mail more from Muscat in due course. Please make a note of my Oman mobile number (for emergency use only), which is +968 92380988. I look forward to seeing you all soon.

Safe travels

Paul o'Dowd
Expedition Leader

31 January

A short video diary entry is now on our Facebook page www.facebook.com/pages/Biosphere-Expeditions/132594724471. You'll find it our Wall page.

1 February

Another video diary entry now at
www.facebook.com/pages/Biosphere-Expeditions/132594724471.

Preparations going well here with half the team now on its way to Salalah to get the equipment down and start setting up. We look forward to seeing you in Salalah in due course. Remember to meet at Costa Coffe opposite departures (not arrivals, where there's also a Costa!).

More updates from Dhofar, but they are unlikely to be video entries from now on because there are now fast internet connections in the land of the leopard ;)

2 February

Did we say no more video diary entries? Well, that would be true if some of us weren't stuck in Muscat. See www.facebook.com/pages/Biosphere-Expeditions/132594724471 for more.

3 February

Half the team is in Salalah buying food & other supplies and sorting out local staff. The other half have had the Land Rover key flown up by a kind passenger from Salalah to Muscat and are now on their way to Salalah, driving 1,000 km along the edge of the Empty Quarter, where roadside cafes have internet and they could upload another video diary entry to www.facebook.com/pages/Biosphere-Expeditions/132594724471 > tab "Wall" (by the way, you do not need to have a Facebook account to view these video diaries - just click on the link above and then the "Wall" tab and you should be able to see everything).

4 February

We're putting up the camp for you at the moment (see new video diary entry on www.facebook.com/pages/Biosphere-Expeditions/132594724471 > Wall) and are on schedule to have everything ready, insh'Allah. When we arrived here yesterday, the place was untouched from last year except for some evidence of camping by locals and lots of hyaena tracks around.

Temperatures are between 12 C at night and around 30 C during the day and, you have guessed it, the sun shines (mercilessly) all day, so don't forget shades, sunscreen, etc.

Again remember that you will be met at Muscat airport by a rep from National Travel & Tourism (NTT) who will hand your tickets to you. If anything goes wrong at that end, you can ring Ginu from NTT on +968 92800281 and you also have my mobile, which is +968 92380988. We'll see you at the Salalah end.

5 February

Base camp is all set and a couple of us are back in Salalah for the night for extreme printing, laminating, shopping, etc. before picking up slot 1 tomorrow. Watch the video diary update on www.facebook.com/pages/Biosphere-Expeditions/132594724471 > Wall and have a read of the attached for what we have in store for you.

8 February

It's day two of the Oman expedition and after a first day of intensive training we have just returned from our first field day. We conducted a survey of Ayun Waterhole and the wadi that contains it. Many tracks were found including some that caused excitement (it's yet to be determined whether that excitement is justified). The appearance of fresh chiapatis at breakfast, courtesy of our great cook Ashraf, made Marcello and Steve very happy. The team have taken to their tasks with great enthusiasm and keen eyes. It's been a pleasure to slowly scan the tracks with Bill regaling us with stories of his diverse experiences and John bubbling with his passion for biochemistry. I look forward to the chance to spend time on the tracks with each of the team over the coming weeks.

PS. Marcello has just returned and crushed our hopes that we had detected a leopard. Our exciting track was made by a hyaena.

10 February

The great wadi search continues as the expedition team spread out into the landscape in search of evidence of our target animals. The Land Rovers and their drivers are each proving very capable on terrain that would seriously tax a lesser vehicle and operator. Gunda has today negotiated a huge day of rock crawling and sand crossings. The inevitable sand bog was easily overcome with a combination of Gunda's cool head in not revving us into a deeper rutt, a lot of dead twigs under the wheels and Bill getting his back into the task of pushing as the vehicle crawled out of its predicament.

Lots of good data and some valuable local interviews made a fun day a productive one as well.

16 February

If ever there was adequate compensation for not finding clear signs of our target species, it couldn't be better than the spectacular scenery we are witnessing as we negotiate this landscape in our surveys (see www.facebook.com/pages/Biosphere-Expeditions/132594724471 > Wall). The wadis constantly remind us of their coral reef heritage as the team trip over fossils of sea shells and ancient corals. In recent days we have conducted interviews with locals and a team has been visiting schools to both spread and aquire information pertinent to our investigation. Anne, with her Arabic skills, and John with his background in education, have been vital to various communications we have initiated in this regard.

Jackpot!! (probably)

Today three teams surveyed three new wadis in the area of Taytum where a couple of local government officials kindly took Marcelo and I with stories of relatively recent sightings. Each looked promising in its own way and, inshalla, we have found signs of the Arabian leopard in two of them with good indications of excellent habitat in the third. Anne found a paw print, which is very likely that of the leopard in a barren-looking dry wadi while Marcello found scratch marks on a wall, which looked to have been made by a young leopard jumping inexpertly onto the ledge above. Needless to say, camera traps have been installed in all three locations. Watch this space...

18 February

As always with field sign, you can't be 100% sure, but Marcelo is quietly confident that we now have evidence of the diner (Arabian leopard) in the area (see www.facebook.com/pages/Biosphere-Expeditions/132594724471 > Wall for an explanation of the "diner" reference). We need to wait for the DNA analysis to come through, and this will take a while, but it's a great step forward.

Today we saw the team from the first slot off at the Salalah airport. I miss them already. That group of people made my job not just easy, but in fact a pleasure. If that is what I have to expect from teams in the future, then I'm a lucky man. To all of you from Slot One, it was a pleasure to meet you and work with you in this beautiful and challenging place. I hope you all take your kit of field research skills and and your fantastic attitudes and lend them to other conservation projects, be it Biosphere Expeditions or elsewhere, in the future. The field needs people like you. Please stay in touch and rest assured that so will we. Thank you, one and all.

21 February

Team two is now settled in at base camp and has just completed the first day of training in the ways of the field researcher. It seems the Force is strong with these ones and I have no doubt that they will contribute greatly to Biosphere Expedition's and Oman's efforts to protect the Arabian leopard.

This afternoon I took half of the many drivers in this team on their 4x4 training session in the Land Rover (see the action on www.facebook.com/pages/Biosphere-Expeditions/132594724471) and, as expected, all were very impressed with the vehicle's capabilities. They all handled the machine with aplomb and with all but two of the team on the driving list, our problem will not be finding enough drivers, but rather finding enough driving to give them all a decent go at the wheel. Marcelo and I are both looking forward to continuing the work we started with the great folk from group one with this eager new team.

28 February

Despite reports of some unrest in Oman, our mountain location remains blissfully quiet. In fact, most of the locals are not even aware of the demonstrations that have happened elsewhere in Oman with the focal point in Sohar, about 1200 km north of here. Needless to say we'll keep our ear to the ground, but as it is now, there is no need to worry. I can't think of a safer place to be than the mountains of Dhofar.

Back to the work in hand, our third day of wadi surveys for the team of slot two was a forey into a previously unvisited area between the dry country of the base camp and the escarpment with its influence from the khareef monsoon. The two survey teams had very ...different experiences within a short distance of each other. One lot found almost nothing of note whilst, searching only 500 meters away, the others came back with a haul of predator scats and skeletal remains.

The day before yesterday, we conducted a number of interviews in the local community. First we had tea with a goat herder and his extended family. They told us a great deal about their relationship with the leopard and confirmed its existence in the area with convincing immitations of a leopard's grunting cough-like call. We also interviewed a very regal looking camel herder who repeated the goat herder's reports of stock loss to leopards and had his son milk a nearby camel for our immediate consumption. The hot frothy milk was excellent and mildly sweet tasting.

1 March

We are now in the camera retrieval phase of the expedition and we have captured a range of images of some interest. Today, camera 4 came in with a caracal trotting down the steps of a waterhole. We've seen a badger, wolves, hyenas, hyrax, and gazelles but as yet, no leopard. After a torturous day in a steep thorny wadi with Bjorn, Julia and Johnathon, Marcello found a large scat which he is pretty excited about. Excitement over excrement for Marcello is cause for hopeful optimism that the scat might just be that of the Arabian leopard.

We now have a box full of scat. I just hope the guys from Land Rover are as excited about us carting it back to civilisation in their beautiful rigs as we are.

The teams who have been on the regular community contact detail have interviewed many people, from goat herders to governors and have amassed an impressive dossier of locations and leads pertaining to stock attacks and sightings of the... Leopard. Most people we've interviewed are convinced that the leopard is resident in the locality with numerous credible accounts of recent contacts and convincing imitations of leopard calls. We have also had a number of candid admissions of a willingness to shoot the animal in an effort to protect livestock. The schools we have visited have expressed a great deal of interest in making our visits a regular annual event and we hope to take them up on their kind invitations.

Tomorrow we are going out to see the uncle of a school girl whose grandfather recently lost a number of goats to something which was in the habit of breaking the necks of its victims.

3 March

Unfortunately, the uncle was not able to take us to a leopard and in fact informed us that the goats were the victims of wolves. His niece had perhaps been a little excited about the possibility of helping these foreign strangers and added some imaginative details to her recollection of her grandfather's stock loss.

Today we broke the back of the big job of packing up the camp at the end of the 2011 expedition. With a bit of time to kill we headed out for a swim at the "local" waterhole. I brought the mask and fins that I have with me for the Honduras Expedition that I will head to after leaving Oman. I got down 11 meters and had further to go before hitting the bottom of the dark and freezing cold crevasse. Very eerie, but beautiful spot.

We will finish the packing tomorrow and head to Salalah to say farewell to the team. Thanks to all for a fantastic effort and some great times.