Status Report for the Arabian Leopard in the Sultanate of Oman

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Once widespread in the mountains of Oman the Arabian leopard disappeared from the Hajar range in 1976 and has not been recorded in the Musandam Governorate since 1997. However, it continues to survive through much of the Dhofar Mountains.
The first significant step to conserve the Arabian leopard was taken in 1985 when the region's first captive breeding group was established. Further important steps were taken in 1997 when Jabal Samhan, a part of the Dhofar Mountains, was declared a Nature Reserve. In the same year the Arabian Leopard Survey was launched and since that time field surveys, camera-trapping and tracking of leopards fitted with GPS satellite collars has not only revealed vital information on the ecology of this species but has helped to keep this flagship species in the public eye.
While new work, from ecotourism initiatives to molecular scatology, is underway further bold steps need to be taken if we are to conserve Oman's and perhaps the regions' last wild Arabian leopard population. Undoubtedly the most important of these is to urgently safeguard the leopards and associated biodiversity of Jabal Samhan Nature Reserve with innovative measures that bring real benefits to the local people.

تقرير حول وضع النمر العربي في سلطنة عمان

ملخص

عاش النمر العربي في الماضي في مختلف السلاسل الجبلية لسلطنة عمان. وفي عام 1976م اختفى من سلسلة جبال الحجر، كما لم تسجل له مشاهدات في محافظة مسندم منذ عام 1997م. ومن يمن الطالع أنه لا يزال يعيش في معظم جبال ظفار حتى اليوم.

تم اتخاذ أولى الخطوات لصون النمر العربي في سلطنة عمان في عام 1985م بتأسيس أول مجموعة من النمور المرباة في الأسر. كما اتخذت خطوات هامة أخرى في عام 1997م حيث تم الإعلان عن جبل سمحان الذي يمثل جزء من جبال ظفار كمحمية طبيعية. كما تم في نفس العام تدشين مسح النمر العربي حيث تم منذ ذلك الحين إجراء مسوحات ميدانية وتصوير النمور بالكاميرات فخية والإمساك ببعض النمور وتطويقها بأطواق محتوية على أنظمة ملاحة فضائية عن طريق ارتباطها لاسلكيا بالأقمار الاصطناعية، الأمر الذي وفر معلومات أساسية حول أيكولوجية النمر العربي وساعد في توجيه الأنظار نحو هذا الحيوان البري النادر.

في حين يتضمن العمل الحالي مبادرات للسياحة البيئية ودراسة جزيئات براز النمر، إلا أن الأمر لا يزال بحاجة إلى اتخاذ المزيد من الخطوات الجريئة إذا ما أردنا المحافظة على آخر تعداد للنمور العربية في السلطنة وربما في المنطقة بوجه عام. ولاشك بأن أهم هذه الخطوات هي الإسراع في تأمين الحماية للنمور والتنوع الأحيائي المصاحب في محمية جبل سمحان الطبيعية مع الأخذ بعين الاعتبار وضع تدابير خلاقة تعود بالنفع على السكان المحليين.

Taxonomy and nomenclature
Specific name: *Panthera pardus*, Linnaeus 1758. Subspecific name: *Panthera pardus nimr*, Hemprich & Ehrenberg 1830. Other names: nimr (Arabic throughout Oman, including Katheeri and Shuhi), aqeydhar (Sahil Al Jazir, Central Region (Jenebi)), qeydhar (Jebali and Mahri).

Status, distribution and development
Detail of distribution records given in Appendix A.In northern Oman leopards once occurred in the massive Hajar range (Harrison 1968) and it is likely they were widespread. However, few records exist and the last confirmed report was of a dead animal in 1976 near Rustak. Today the leopard is considered to be absent from the Hajar range (Anon 1997).

In the Musandam Peninsula there was a spate of reports of illegal killings of leopards in the late 1970s and early 1980s. In 1980 alone eight leopards were reported killed by local shepherds. Further killings occurred in the 1990s, the most recent record is of two leopards caught in a leghold trap and then shot, by citizens from outside Oman, on Omani territory in October 1997. There are no confirmed sightings since that time although there have been reports of further killings in adjacent territory of the United Arab Emirates (UAE) as recently as 2001 (Jongbloed 2001). Recent camera-trapping projects in the UAE have not been successful (CBSG 2002). Illegal hunting and illegal persecution by local shepherds have probably been the main contributors to the demise of the leopard. If the leopard is still present in Musandam and the northern Emirates then numbers are likely to be in single figures (CBSG 2002).

In the Dhofar Mountains the presence of leopards was recorded by Thomas (1932) and Thesiger (1949). Founders for the first captive breeding group of Arabian leopard, established at the Breeding Centre for Omani Mammals in Muscat, were caught in Jabal Samhan in 1985 (Usher-Smith 1985). In 1995 David Willis succeeded with camera-traps to photograph leopards in Jabal Samhan and during the years 1997-2000 the Arabian Leopard Survey recorded 17 individuals using camera-traps (Fig. 2; Spalton & Willis 1999, Spalton *et al*. 2006). Since 2000 an ongoing programme of camera-trapping and satellite tagging of leopards has confirmed the continuing presence of leopards elsewhere in the mountains of Dhofar, from Salalah west to the border with Yemen (Office of the Adviser for Conservation of the Environment [OACE], unpubl. data). Illegal killing by local shepherds is probably the primary threat to leopards in Dhofar.

Fig. 1. Historical (hatched), confirmed (red) and possible (green) occurrence of Arabian leopard in Oman.

Habitat
While we do not know what constitutes prime habitat it is likely that the woodlands, scrub and grasslands of Dhofar were once, and still may be, the best habitat for leopards. Woodland, dominated by *Anogeisus dhofarica*, predominates on many parts of the steep south-facing escarpment of Jabals Qara and Qamar. The canopy is relatively open and ground cover is good. Above the woodlands are tall grasslands, which cover the plateau (Reade *et al*. 1980). While neither the woodlands nor grasslands support medium or large sized wild herbivores the areas do support smaller species such as rock hyrax *Procavia capensis jayakari* and although not documented smaller mammals, birds and reptiles are likely to be widespread. However, these areas also have the greatest density of people and domestic stock that has led to rapid degradation of these habitats over the last 20 years (Ghazanfar 1999).

Fig. 2. Leopard pair camera-trapped in Jabal Samhan Nature Reserve (Photo A. Spalton).

Today the best habitat for the leopard is likely to be the Acacia dominated scrub of the southern escarpment of Jabal Samhan (Fig. 3) and the semi-desert of the interior and northern aspects of Jabals Samhan, Qara and Qamar that lie outside the monsoon area. Here herbivores including Nubian ibex *Capra ibex nubiana* and Arabian gazelle *Gazella gazella* still survive and densities of people and livestock are low (OACE, unpubl. data). The declaration of Jabal Samhan as a Nature Reserve has increased the level of protection of the leopard and its habitat.

The mountains of northern Oman (Musandam and the Hajar range) must today be considered to be marginal habitat for the leopard. Although the Arabian tahr is still relatively common in the Hajar mountains (Insall 1999) other herbivores, particularly the gazelle, have gone from many areas. Hyraxes are not found in northern Oman and thus medium sized prey species are virtually absent. Over-browsing and grazing by goats and feral donkeys has degraded the vegetation as has clearing for houses and road building in recent years (Ghazanfar 1999).

The only protected area within the range of existing leopard populations is Jabal Samhan Nature Reserve (NR). Declared by Royal Decree in 1997 it covers 4,500 km^2. Rangers of the Ministry of Regional Municipalities, Environment & Water Resources (MRMEWR) operate within the reserve.

Prey species

A provisional study by Muir-Wright (1999) of 74 leopards scats collected in Jabal Samhan NR found the following 9 prey groups, given here in decreasing order of importance: - Arabian gazelle, Nubian ibex, Cape hare *Lepus capensis cheesmani*, rock hyrax, birds, Indian crested porcupine *Hystrix indica*, Ethiopian hedgehog *Paraechinus aethiopicus*, small rodents and insects. Since 1999 a further 200 scats have been collected and pooled with the existing 74 scats for a further analysis by the University of Aberdeen. Results have yet to be published.

Ibex were the most frequently recorded ungulate during three years of camera trapping work of the Arabian Leopard Survey in Jabal Samhan (Fig. 4) . They were found throughout the wadis and high plateau but were not recorded on the face of the southern escarpment (Spalton et al. 2006). Ibex are also present in the dry areas of Jabal Qara and Qamar (MRMEWR, unpublished records). However, nothing is known of any population trend. Gazelle were also recorded in Jabal Samhan although only on the high plateau. Hyrax, porcupine and hedgehog were recorded in Samhan and except for hedgehog have also been camera-trapped in Jabal Qamar. Hyrax colonies are seen throughout the Dhofar mountains in spite of the fact that they are still hunted for their meat in Jabals Qara and Qamar (OACE, unpubl. data). Arabian red-legged partridge *Alectoris melanocephala*, small rodents and reptiles are ubiquitous in the Dhofar mountains.

The Arabian leopard, like the African leopard, is likely to be an opportunist and may on occasions take other species such as Blanford‘s fox *Vulpes cana* and African small-spotted genet *Genetta felina grantii* although scat analysis found no supporting evidence (Muir-Wright 1999). Similarly leopards in Jabal Samhan might also take goats, young camels and young donkeys while to the west (Jabals Qara and Qamar) cattle might occasionally be preyed upon.

Domestic animals

The peoples of Jabal Qara and Qamar have traditionally herded cattle on the mountain pastures as a form of livelihood (Reade *et al.* 1980). Numbers were limited by natural factors such as the absence of perennial water, the need to provide food supplement (dried sardines) during winter months and the presence of biting flies during the monsoon (Lawton 1978). These coupled with the management of stock on a tribal basis prevented numbers from exceeding the carrying capacity of the Jabal. The peoples of Jabal Samhan traditionally raised camels and goats. The increased availability, after 1970, of services such as veterinary care, subsidized feed, improved water supplies and new sources of income that allowed the purchase of additional animals catalysed rapid increases in livestock numbers and particularly in numbers of camels (Zaroug 1983). The main perceived problem is the intrusion of camels into cattle grazing areas, not just seasonally but throughout the year (Morris 1986). While cattle and goats still tend to be corralled at night time, camels are not and are thus on the jabal year round and 24 hours a day. During the monsoon cattle are corralled during daytime, because of biting flies, and thus are grazed and watered at night.

Sale in Reade *et al.* (1980) reported, “…leopards do kill domestic stock and are thus a menace to pastoral people…”. This is likely to be the case and many, if not most, people consider the leopards a threat to their domestic stock. However, nothing is known of the frequency that leopard actually take livestock. The likelihood of livestock predation is gre-

atest in Jabals Qara and Qamar where camera trapping and satellite tracking has shown leopard ranging close to settlements and in areas of high density of domestic stock (OACE, unpubl. data). In 2001 and 2002 local people reported leopard to have killed camels in an area of Jabal Qamar (A. S. Bait Said, unpubl. data). Camera trapping in the same area in 2002 proved that leopards were indeed present as were caracal *Caracal caracal schmitzi*, striped hyaena *Hyaena hyaena sultana* and Arabian wolf *Canis lupus arabs* (OACE, unpubl. data). In Jabal Samhan there was no evidence of domestic species in the diet of the leopard (Muir-Wright 1999).

Fig. 3. Woodland habitat of the Dhofar mountains (Photo A. Spalton).

Legal status

In Oman the leopard is protected from hunting and capture (Ministerial Decision 101/02, Royal Decrees 111/96, 75/98, 114/2001 & 6/2003). Under Royal Decree 6/2003 the penalty for hunting or capture of leopard, an Appendix 1 species, is imprisonment for not less than six months and not exceeding 5 years and a fine not less than R.O. 1000 and not exceeding R.O. 5000.

Of the key prey species of the leopard the Arabian gazelle and Nubian ibex are all also on Appendix 1 of Royal Decree 6/2003. All other species are also protected by law and are listed on Appendix 2 of Royal Decree 6/2003.

Red List status is as follows: Global: CR C2a (IUCN 1996a). National: CR D, C2a (Terrestrial Mammal Group, Directorate General of Nature Conservation, MRMEWR).

Protection status: Global: CITES Appendix 1 (IUCN 1996b).

Conflicts and public awareness

The primary conflict is that the leopard will on occasions take domestic animals. The frequency of such livestock killing is unknown and in many cases the leopard is probably often blamed for kills by wolves and more often for livestock losses where no clear cause can be identified. Nevertheless the general and widely held view is that the leopards prey upon domestic stock. The knowledge that the leopard is protected has lead local people to request compensation from the concerned government bodies. There is no scheme for compensation at this time and this issue is itself a source of potential conflict. The recruitment of rangers from areas within the range of the leopard by the MRMEWR has helped gained some support for conservation efforts. The establishment of Jabal Samhan Nature Reserve has led to little conflict in resource use since few local people enter the reserve. However, there is a need to manage the activities of frankincense harvesters in the reserve.

Public awareness programmes have been carried out by MRMEWR and OACE locally and nationally. At a national level numerous brochures, booklets and other materials have been published and distributed. In 2001 and 2002 MRMEWR public relations staff accompanied by rangers visited six schools in the areas around Jabal Samhan Nature Reserve and in Jabals Qara and Qamar. At each school they gave presentations to the children on the wildlife of Dhofar with particular emphasis on the leopard. Similar presentations have been made to two gatherings of local people in Jabal Qamar. A booklet on Jabal Samhan Nature Reserve was printed in 2001 and distributed to the general public.

The Office of the Adviser for Conservation of the Environment (OACE) produced a short video documentary, a booklet, a poster and six information panels on the work of the Arabian Leopard Survey in Jabal Samhan Nature Reserve. This material was exhibited at a forum on Desertification held in Salalah in March 2002 and at the annual Khareef Festival since 2004.

Table 1. Specimens of Arabian leopard kept at the Oman Natural History Museum.

Accession No.	Description	Origin
ONHM 135	Complete	Musandam 1981
ONHM 503	Complete	Jabal Samhan 1985
ONHM 1064	Skull	Musandam 1980
ONHM 1065	Skull	Musandam 1980
ONHM 1288	Complete	Bait Barakah Breeding Centre 1989
ONHM 1523	Complete	Bait Barakah Breeding Centre 1990
ONHM 2295	Skull	Dhofar 1994
ONHM 2756	Complete	Bait Barakah Breeding Centre 1997
ONHM 3299	Complete	Jabal Samhan 2002

People and institutions

The primary authority for conservation of Oman's wildlife is the MRMEWR, and in particular the Directorate General for Nature Conservation in Muscat

Fig. 4.Nubian ibex and kid camera-trapped (Photo A. Spalton).

and the Directorate General for Environment in Dhofar. The MRMEWR employ 38 wildlife rangers in Dhofar.

The Office of the Adviser for Conservation of the Environment in the Diwan of Royal Court commenced the work of the Arabian Leopard Survey in 1997. This has comprised field research and studies in Jabal Samhan Nature Reserve and since 2000 in Jabals Qara and Qamar. In 2006 surveys were undertaken with Biosphere Expeditions in the Musandam peninsula.

The Directorate General of Royal Farms & Gardens of Royal Court Affairs is responsible for Oman's only group of captive leopards held at the Bait al Barakah Breeding Centre for Omani Mammals, Muscat.

In 2002 an Arabian Leopard Working Group was established under the chairmanship of the Director General for Nature Conservation of the MRMEWR and members include representatives from the OACE and the Sultan Qaboos University.

Inventory

The Oman Natural History Museum, Ministry of National Heritage and Culture holds nine specimens of Arabian leopard (Table 1).

Seven animals are kept at the Bait Al Barakah Breeding Centre for Omani Mammals, Directorate General of Royal Farms & Gardens, Royal Court Affairs, Muscat (Table 2).

Ongoing work

OACE is continuing the work of the Arabian Leopard Survey as follows:

• *Camera-Trapping* in the Dhofar Mountains. Camera-trap survey work continues across the Dhofar mountains to determine the continuing presence or absence of leopards and to ascertain the degree of fragmentation of the population. This work is being carried out in conjunction with staff of MRMEWR.

• *Investigation of Livestock Killing.* Camera trapping, satellite tracking and molecular scatology are being used to help the MRMEWR to investigate cases of reported livestock killing by wild animals and thus be better equipped to address the issue of compensation.

• *Genetic Studies*. Staff of the Biology Department, College of Science, of the Sultan Qaboos University are developing genetic techniques to identify leopard and other large carnivores (wolf, hyena and caracal) from scats (faeces) collected on the jabal. To date DNA has been successfully isolated from tissue material and scats of captive (Al Ansari *et al*. 2005) and wild leopards (Pers. comm. Al Ansari, January 2006).

• *Satellite GPS Tracking*. Four GPS satellite collars have been recovered from leopards captured in Jabal Samhan and Jabal Qamar. Data is being analysed that will give vital range information for male and female leopards. Collaring will continue in order to further investigate the ecology of the species and especially to investigate interaction of the leopard with people and their livestock.

• *Surveys in Governorate of Musandam*. In January 2006 OACE joined up with Biosphere Expeditions to carry out survey work in Musandam while simultaneously helping to develop responsible tourism (www.biosphere-expeditions.org).

• *Education & Public Awareness Material*. Staff continue to work with local schools and government offices to disseminate information.

• *Documentary Film*. David Willis has been contracted to produce the region's first documentary film about the leopard and the work of the Arabian Leopard Survey. Leopard footage will be obtained from video-camera traps.

Table 2. Animals kept in captivity (in and outside Oman) in December 2006.

Studbook Nr	Sex	Birth date	Sire	Dam	Location	Date	Local ID	Event	Name
8	M	05.05.93	1	3	BC-Oman	05.05.93	M267	Birth	Mohan
10	M	24.02.95	1	3	BC-Oman	24.02.95	M297	Birth	Zeak
12	M	~ 1993	wild	wild	Yemen	~ 1994	UNK	Capture	Nimrod
					Private	~ 1994	UNK	Transfer	
					Sharjah BR	18.05.95	PP001	Loan to	
					BC-Oman	03.05.97	UNK	Loan to	
					Sharjah BR	12.02.98	PP001	Transfer	
					BC-Oman	30.04.02	M350	Loan to	
17	F	21.02.97	1	7	BC-Oman	21.02.97	M342	Birth	Riha
18	F	21.02.97	1	7	BC-Oman	21.02.97	M343	Birth	Badria
3	F	~ 1984	wild	wild	BC-Oman	~ 1985	UNK	Capture	Nesra
					BC-Oman	~ 1985	M112	Transfer	
					Sharjah BR	04.05.97	PP003	Loan to	
6	F	15.05.90	1	3	BC-Oman	15.05.90	M214	Birth	Hesra
					Sharjah BR	11.11.95	PP002	Loan to	

Recommendations

Survey & Research. To continue with current programs (identified above) for survey and research including investigations into livestock killing by large carnivores.

Implementation of Management Plan. To strengthen efforts to implement the management plan for Jabal Samhan Nature Reserve.

Public Education Campaigns. To continue with these in schools and public forums.

Social Survey. In order to understand what the leopard means to the local people of Dhofar it is recommended that a survey be carried out within leopard range areas to determine attitudes and needs of local human communities.

Captive Breeding. Maintain the captive group and encourage new breeding loans with collections outside Oman in order to avoid inbreeding and to broaden the genetic base.

Collaboration with neighbouring range states. To investigate the possibility of surveying areas within Yemen close to the Oman – Yemen border and give assistance, where appropriate, to conservation authorities in Yemen.

Regional Conservation Initiatives. To support efforts to develop a Strategic Plan for the conservation of the species.

Fig. 5. Education to engage young Omanis in leopard conservation (Photo A. Spalton).

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Appendix A: Distribution records
Reports classified as confirmed (when animal remains have been collected, or animal photographed and clearly recognisable) or unconfirmed (all others). Names after records indicate a personal communication, the location of which is given in notes below.

Musandam

Confirmed reports

1976: Young female killed, skull collected, near Limah (N. McNeil[1]).
1979: Animal shot and recovered in Wadi Maqalayli; (R. Thompson[2]).
1980: Eight leopards killed, some recovered whole, parts of others collected; female at Al Hawshak, male at Qusaydat, unknown sex west of Wadi Jellabat, unknown sex at Al Mintera, male at Algema, male west of Wadi Jellabat, male[3] at Al Alama and female[3] west of Limah (S. Gordon[4]).
1981: January, male[3] was killed and recovered near Taf al Qarha; (G. Walker[5]).
February, adult photographed dead at Khasab (R. H. Daly[6]).
1990: February, male shot and photographed, near Khasab (D.M. Fernie[7]).
1992: November, male killed in Wadi Zibat on the border of Oman and Ras Al Khaimah. Head recovered to Arabian Leopard Trust (G. Feulner[12]).
1997: October, two leopards caught in a leghold trap and then shot, by men from outside Oman, on Omani territory close to the border with RAK (David Insall[8]).

Unconfirmed reports

1994: Locals reported single sightings at Bait Shaikh, Khasab, Jabal Jemayaim (D. Insall[8]).
Other sightings have been documented for the Oman / UAE border (Anon 1995).

Northern Oman

Confirmed reports

Undated: M.P. Butler obtained an incomplete skin from locals SW of Ibri (Harrison 1968)
1976: Animal of unknown sex was shot and later photographed near Nakhl (Gasperetti et al 1986).

Unconfirmed reports

1976: footprints similar to leopard spoor found near Warrawarra in the Wadi Sareen Reserve (Munton 1985).
1979: Single leopard seen by a local person in Jabal Alka, to the south of Wadi Sareen (D. Insall[8]).

Dhofar and Central Oman

Confirmed reports

Presence in the Dhofar mountains noted by Thomas (1932) and Thesiger (1949).
1947: Specimen from Jabal Samhan (Harrison 1968).
1948/49: Specimen from Dhofar (Harrison 1968).
1977: Two specimens Jabal Samhan; one recovered dead (Gasperetti *et al*. 1986) and a skin received by the Oman Flora & Fauna Survey, 1977 (Reade et al. 1980.).
1985: Four animals (2.2) trapped in Jabal Samhan and taken to the Breeding Centre for Omani Mammals (Usher Smith 1985).
1988: Dead animal photographed near Sadh (R. Wood[9]).
1994: Skull and other remains of a single animal near Jibjat (A.G. Boulter[10]).
1995-2000: Photographs of 17 different individual leopards made by camera-trap in Jabal Samhan Nature Reserve (Spalton & Willis 1999, Spalton et al. 2006).
2001-2005: Six individuals trapped for fitting with GPS collars in Jabal Samhan Nature Reserve and two in Jabal Qamar (OACE, unpublished data).
2001-2005: Photographs of 9-11 different individual leopards made by camera-trap in Jabals Qara and Qamar (OACE, unpublished data).

Unconfirmed reports:

1994: Single animal reported in Wadi Mughsayl and one in Wadi Jardoom (Ali Salim Bait Saeed[11]).
1995: Two adults with three young reported between Sadh and Hadbeen (Ali Salim Bait Saeed[11]). Single leopard seen in Wadi Hanna in 1995, another in Wadi ‘Aynenya (D. Insall[8]).
1996: Single animals seen in Wadi Naheez and Wadi Seeq (D. Insall[8]).

Notes on source of information

1. Office Adviser Conservation of the Environment (OACE; PS2/6-10/76)
2. OACE (C6/45/79)
3. also Gasperetti et al 1986
4. OACE (C6/56 & 60 /80)
5. OACE (C6/64-68/81)
6. OACE (with photograph; C6/74/81)
7. OACE (with photographs; PS2A/9/90)
8. David Insall, pers. comm.
9. Richard Wood, pers. comm.
10. OACE (PS2/29/94), specimen ONHM 2295
11. Ministry of Regional Municipalities, Environment & Water Resources.
12. Gary Feulner, pers. comm. February 2003.