

# Status of the Arabian Leopard in United Arab Emirates

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Experts estimate the wild population of Arabian leopard (*Panthera pardus nimr*) in the Northern Emirates and Musandam Peninsula to be as low as 5–10; however, the UAE does not have the area capacity to carry a population larger than 10–20 animals. In recent historic times, the caracal is thought to have become an apex predator in areas not used by the Arabian leopard. Its predominance in many wadis may therefore serve as an indicator for declined/extinct leopard populations. Very little is known about the primary and marginal habitats of the Arabian leopard in the UAE, assessment is based on scattered reports and knowledge of leopards from other regions. It is thought that the UAE provides a corridor for leopards moving between the Musandam Peninsula and the Al Hajar Mountains of Oman, although the leopard may be extinct from the Al Hajar Mountains. Accurate data regarding the distribution, ecology and behaviour of the Arabian leopard will enable suitable protected areas to be planned and proposed.

يقدر الخبراء اعداد النمر العربي (بانثرا باردوس نمر) في البرية في الامارات الشمالية وشبه الجزيرة العربية مسندم منخفضة بحيث لا يتجاوز 5-10 نمر ، وتعتبر بيئات النمر العربي في دولة الامارات محدودة المساحة بحيث لا تتحمل أكثر من 10-20 حيوان وذلك حسب طبيعة هذا الحيوان البري والذي يحتاج الى مساحات كبيرة ( 15 كيلو مربع لكل ذكر بالغ). وفي السنوات الاخيرة بدأ ظهور حيوان الوشق كمفترس رئيسي في البيئات التي كان يعيش فيها النمر العربي حيث تؤخذ هذه الظاهرة كمؤشر على اختفاء او إنقراض النمر العربي من بيئاته الطبيعية، هذا من ناحية ومن ناحية اخرى كان المعلومات عن المواطن الاساسية والنادرة للنمر العربي تعتبر شحيحة ، الى ما توفر عن هذه البيئات في مناطق اخرى. وتعتبر المناطق الواقعة في جبال الحجر لدولة الإمارات مناطق ممر للنمر العربي التي تنتقل من شبه جزيرة مسندم وبقية جبال الحجر في عمان. ومن اجل الحفاظ على النمر العربي فإنه من المهم ايجاد قاعدة معلومات دقيقة عن ( توزيع النمر العربي في البرية ونظم البيئية التي لعبت فيها بالاضافة الى سلوكيات هذا الحيوان الخجول، مما سيتيح الفرص لإقتراح وإنشاء مناطق محمية صالحة للنمر العربي.

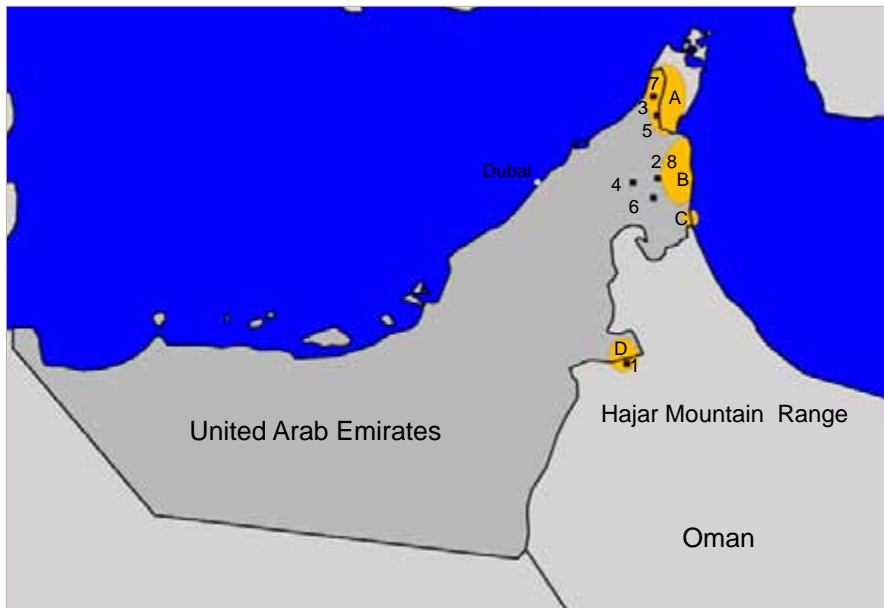
## Status, distribution and development of the Arabian leopard population

Limited literature exists upon which to base an estimate of the historical distribution of the Arabian leopard in the United Arab Emirates (UAE). Reports, kills and sightings of leopard are rare and recorded knowledge is often based on hearsay.

The Arabian leopard was first recorded in the UAE by Thesiger (1949) who reported the presence of a visiting leopard on Jebel Hafit (1 in Fig. 1). Hellyer (1993) also reported leopard on Jebel Hafit with an account of one that was shot and wounded in 1976. Harri-

son (1968) refers to a report from Tyrell of a leopard shot near Masafi (2 in Fig. 1) in 1962 and a leopard sighting is recorded at the Qalidda Pass in Harrison (1971) and Harrison & Bates (1991). Press reports (1993) document a group of three leopards that were killed in a cave in Ras al Kaimah in 1986 (3 in Fig. 1). As leopards do not usually remain in groups it is assumed that this group was a mother with sub-adult cubs. Another leopard was killed in Ras al Khaimah in May 1993 (5 in Fig. 1); this kill was apparently corroborated with photogra-

phic evidence (IUCN/SSC Conservation Breeding Specialist Group CBSG 2000). Spalton *et. al.* (2006) report that two leopards were killed in the Musandam in 1997 and Jongbloed (2001) recorded the killing of a female in Ras al Khaimah in 2001 (7 in Fig. 1). Llewellyn-Smith also found signs thought to be leopard in Wadi Zeebat in 2001 (Fig. 2 and 3). According to Spalton *et al.* (2006), the last report of leopard in the adjacent Al Hajar Mountain was in 1976. Oman authorities now consider leopard extinct in this region. Recent



**Fig. 1.** Information on protected areas and distribution of the Arabian leopard in the United Arab Emirates. Protected areas (yellow): A = Ru'us al Jibal (proposed), B = Al Hajar-Shumayliya Mountains (proposed), C = Mangrove Community at Khor Kalba (proposed), D = Jebel Hafit (declared). Observations (black squares): 1 = Jebel Hafit 1976, 2 = near Masafi 1962, 3 = Ras al Kaimah 1986, 4 = near Manama, 5 = Ras al Kaimah 1992 and 1993, 6 = Wadi Shawka 1995, 7 = Ras al Kaimah 2001, 8 = Wadi Wurayah 2004.

field surveys conducted by Biosphere in 2005 found no evidence of leopard in the Musandam (Spalton *et al.* 2006).

During the course of a field survey in 1995, evidence of leopard sign (tracks in Wadi Shawka) in the UAE was suggested (6 in Fig. 1), however, the authors express doubt about the occurrence of any resident leopards due to the lack of other signs confirming their presence

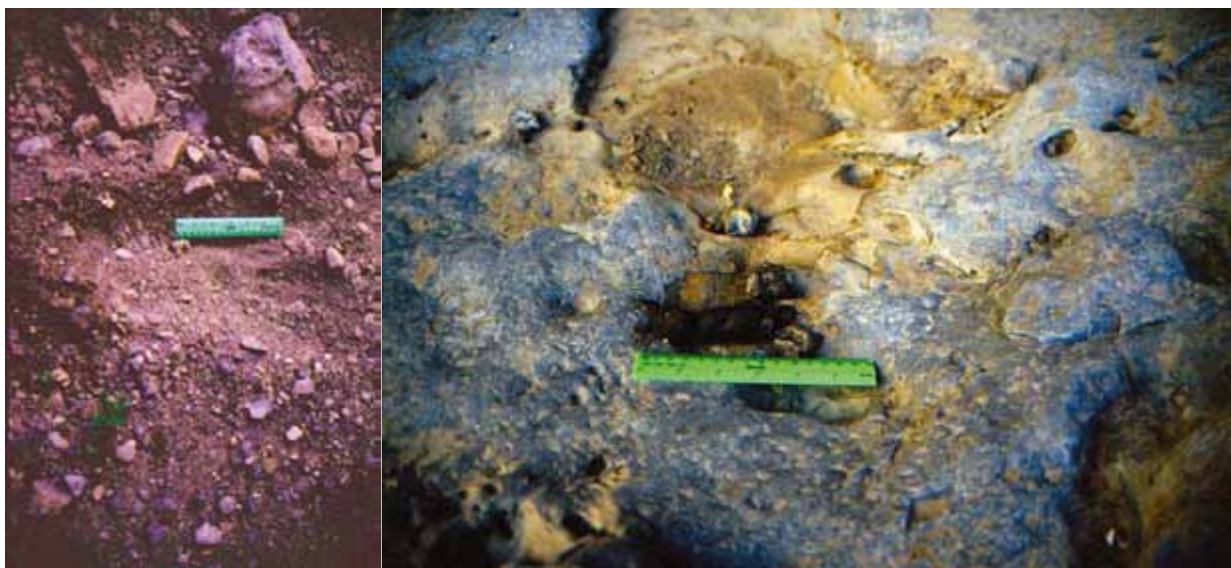
(Stuart & Stuart 1995). It should also be noted that this wadi is known to support caracals. Caracal and leopard are not often found to inhabit the same home range (A. Spalton, pers. comm.).

Faecal samples collected from Wadi Wurayah were analysed at King Khalid Wildlife Research Centre (KKWRC) in Saudi Arabia and identified as Arabian caracal *Caracal caracal schmitzi* drop-

pings. In recent historic times, the caracal is thought to have become an apex predator in areas not used by the Arabian leopard (A. Spalton, pers. comm.). Its predominance in these wadis may therefore serve as an indicator for declined/extinct leopard populations.

A single footprint was photographed by D. Egan from a shallow rock cave in Wadi Wurayah in 2004 (8 in Fig. 1). The print was found in soft powder-like sand on rock. Size comparisons with prints of Arabian leopard and Arabian caracal made in soft sand at the Breeding Centre for Endangered Arabian Wildlife (BCEAW), Sharjah indicate that it is similar in size to those of the leopard but could also be from a large/male caracal. The print had insect prints over it. There were no other signs (faeces, scrape marks, carcass remains etc.) indicating that the cave was used for any length of time.

During a Conservation and Assessment Management Plan (CAMP) workshop for Arabian Carnivores held in Sharjah in February 2000, experts estimated the wild population in the Northern Emirates and Musandam Peninsula to be as low as 5–10 (CBSG 2000). The home range of Arabian leopards on Jabal Samhan is about 350 km<sup>2</sup> for males and 250 km<sup>2</sup> for females (A. Spalton, pers. comm.). With an approximate mountain area of 3,200 km<sup>2</sup>, the UAE does not have the capacity to carry a population larger than 10–20 animals.



**Fig. 2 and 3.** Photos taken in Wadi Zeebat in 2001. The signs are thought to be leopard scraping (left) and leopard faeces (right; Photos R. Llewellyn-Smith).

## Threats

The general consensus amongst locals and experts is that the population is decreasing at an unsustainable rate. Live animal trade, trade for parts (pelts) and indiscriminate hunting are thought to have the greatest effect on population numbers (CBSG 2000). Direct persecution due to predator-livestock conflicts occurs and local farmers and shepherds are also known to be of the opinion that any predator threatening their livestock will be shot.

Competition with man in early years was restricted by natural factors such as limited perennial water and inability to easily access wadis containing water. Farming was limited to the carrying capacity of the natural environment. Recent years have witnessed a rapid increase in development throughout the UAE as a result of new wealth generated mainly from the discovery of major oil resources. Construction of new roads (Fig. 4) and highways across the country and expansion of the many small villages scattered throughout the mountains has resulted in important habitat fragmentation for many species. Improved availability of resources such as pumped water has led to increased cultivation (Fig. 5) and overexploitation of limited wadi resources. Also of enormous impact to the loss of viable habitat is extensive quarrying of the Shumayliya Mountains (Fig. 6) for the construction of multiple off-shore residential and pleasure islands along the UAE coastline.

Hunting and increased livestock numbers have resulted in a decrease of natural prey species, such as Arabian tahr *Hemitragus jayakari*. During a survey conducted by the BCEAW at perennial water holes of various wadi branches in the Shumayliya Mountains (B in Fig. 1) it was confirmed that Arabian tahr do still occur in the region but in very limited numbers. The survey, which was conducted between June 2000 and January 2002, included camera trapping, behavioural observations and faecal sample collection. During the 18-month period only thirteen photographs of tahr were obtained (Ruddock 2002, Ruddock & Smith 2002). There were five live animal sightings (Ruddock & Smith 2002) one of which was photographed (Fig. 7).



**Fig. 4.** Construction of roads allows access to remote areas (Photo J. Edmonds).



**Fig. 5.** Widespread farming now occurs in the mountains (Photo J. Edmonds).

Local residents are known to have limited interest and awareness of the natural history of the UAE. A popular pastime enjoyed by both locals and expatriates in the region is “wadi-” and “dune-bashing”, which requires careful attention. Aside from the impact of noise and disturbance on the habitat, problems such as plant and animal destruction, erosion and pollution have a negative impact on these fragile habitats.

## Habitat

Leopards have a wide habitat tolerance but are generally associated with rocky hills and mountainous ranges (Fig. 9 and 10; Skinner & Smithers 1990, Harrison & Bates 1991). They are said to seldom venture onto the open plains (Harrison & Bates 1991) however; an individual trapped in the early 1990’s was in fact caught on the open plains near Manama (4 in Fig. 1). Leopards are believed to be absent from the true desert of the central Arabian peninsula (Harrison & Bates 1991).

The Shumayliya Mountains run from north to south along the east coast of the UAE, covering an approximate area of 3,200km<sup>2</sup>. Scrapings, tracks and kills have all been found in mountain wadis with permanent water (CBSG 2000, R. Llewellyn-Smith, pers. comm. and D. Egan, pers. comm.).

Not enough is known about the habitat of the Arabian leopard to accurately identify primary or marginal habitat in the UAE, assessment is based on scattered reports and knowledge of leopards from other regions. It is thought that the UAE provides a corridor for leopards moving between the Musandam Peninsula and the Al Hajar Mountains of Oman (CBSG 2000). However, it should be noted that the leopard is considered to be absent from the massive Al Hajar Mountain range in northern Oman (Spalton *et al.* 2006) and the existence of a corridor today would therefore be redundant.

Whilst the leopard itself is said to be independent of water and able to obtain



**Fig. 6.** Destructive impact of quarrying for the construction of multiple off-shore residential and pleasure islands along the UAE coastline. This quarry is situated near Wadi Shawka (Photo J. Edmonds).



**Fig. 7 and 8** Evidence of the occurrence of Arabian tahr in the Shumayliyah Mountains of the UAE. The image on the left is the single photograph obtained from a live sighting of tahr in Wadi Wurrayha, photographed by Mike Smith. The image on the right is one of the 13 photographs of tahr obtained by camera traps during the Shumayliya Mountain survey carried out by the BCEAW between June 2000 and January 2002.

moisture requirements from prey (Skinner & Smithers 1990), some prey species occurring in the UAE, such as the tahr, are water dependant. Water could therefore be considered a limiting factor for the occurrence of Arabian leopard.

No suitable protected areas exist in the UAE, Jebel Hafit - Ain al Faydah (D in Fig. 1) near Al Ain has been declared a National Park. The area covers 11,700 ha. Since 2003, intensive effort has been employed to eradicate feral sheep and goats from the Jebel and thereby allow the expansion of a healthy tahr population from the present population in the region (C. Drew, pers. comm.). Hatta Nature Reserve (see map) has been designated a protected area since 2003. This land area covers 16 km<sup>2</sup>. Protection has been proposed for an area of the Ru'us al-Jibal Mountains (A in Fig. 1) that is thought to be visited by leopards (Llewellyn-Smith 2002). The proposal has yet to be accepted.

During their study of the UAE flora and fauna, Chris and Tilde Stuart (1995) suggested the Shumayliya-Hajar moun-

tain region on the east coast of the UAE be included as a protected area (B in Fig. 1). If the UAE does form an important corridor for migrating leopards to move between the Hajar Mountains and the Musandam Peninsula, protection of the Shumayliya-Hajar region would reduce the vulnerability of leopards moving through this north/south corridor and may allow repopulation of the Al Hajar Mountain region.

#### Prey Species

Although there are no official statistics to refer to, experts have consistently concluded that traditional prey species for the Arabian leopard are in a state of decline (CBSG 2000 and 2001, Environment and Protected Areas Authority 2002, 2003, 2004, 2005 and 2006).

According to a study of the diet of the Arabian leopards, traditional prey species in Oman consist of the Arabian tahr *Hemitragus jayakari*, mountain or Arabian gazelle *Gazella gazella cora*, Ethiopian hedgehog *Paraechinus aethiopicus*, small rodents, reptiles and even

insects (Muir-Wright 1999). Also identified by Muir-Wright (1999) as part of the main constituent of a leopard's diet is the Cape hare *Lepus capensis cheesmani*, which is still present on the plains of the UAE (Drew 2000) and Rock hyrax *Procapra capensis*. Rock hyrax (Fig. 11) is not a traditional prey species in the UAE as they are not endemic. They were however introduced onto the Jebel Hafit and a leopard population existing on or near Jebel Hafit would likely utilize the hyrax as a primary food source.

Skinner & Smithers (1990) record that African leopards prey on whatever is available within their home range. As with other leopard sub species, the Arabian leopard is likely to be an opportunistic hunter and it is therefore possible that the Blanford's fox *Vulpes cana* and White-tailed mongoose *Ichneumia albicauda* would form an occasional part of the diet of the Arabian leopard. There is however, there is no scientific evidence to support this statement.

#### Domestic animals

There is very little proof that loss of livestock in the UAE is due primarily to the Arabian leopard; although as a result of a lack of other suitable prey within the leopards' range it is not unlikely that livestock is killed. Leopards do have a widespread reputation as a killer of domestic livestock (Roberts 1977, Harrison & Bates 1991).

An informal survey conducted by Moaz Sawaf on behalf of the Arabian Leopard Trust (ALT) during 1993 (Jongbloed 2001) revealed that all farmers in the mountains kept free-ranging goats, the numbers ranging from 50–500. These goats compete with Arabian tahr for grazing ground (Fig. 12). A large portion of the farmers questioned (75 %) said that wild predators killed their goats from time to time but whilst everyone questioned had seen caracals, less than half had ever seen a leopard. Many of the farmers said they would refrain from hunting the leopard if compensation for lost goats was paid to them. A later community survey conducted by Moaz Sawaf on behalf of Chris and Tilde Stuart in 1995 revealed similar statistics (Stuart & Stuart 1995).

No compensation system for losses of livestock exists within the UAE. No-



**Fig. 9.** Mountain habitat of the UAE (Photo J. Edmonds).



**Fig. 10.** Wadi bed in the Shumayliyah Mountains (Photo J. Edmonds).

teworthy with regard to these surveys is that many locals refer to any large cat or canid as “nimr” raising the question of data authenticity (CBSG 2000, personal observation). Stuart & Stuart (1995) also expressed doubt about validity of data provided in their survey report.

Methods used for animal management by locals vary considerably from tribe to tribe. Many goat herds are free ranging, although in some areas, particularly the larger villages, the herds are sometimes kept in primitive kraals (fenced area). A small number of farmers enclose newborn goats until they are old enough to keep up with the main herd. Research in the Ru’us al Jibal area of Ras al Kaimah revealed that local tribesmen employ “herdsmen” to live in the mountain settlements tending the goatherds (Jongbloed 2001).

**Legal Status**

- The Arabian leopard is classified as *Critically Endangered* (CR) in the global IUCN Red List.
- Under the CITES (Convention on International Trade in Endangered Species) treaty it has been listed in Appendix 1 since 1975 and is therefore protected from international trade through UAE custom points.
- Federal Law 11, implemented on 26 April 2003, protects all CITES listed species. This law does not apply for species or trade within a country. Implementation of animal trade laws within the UAE is not consistently enforced. There is no federal legislation officially protecting the Arabian leopard within the country.
- Federal Law no. 24 of 1999 Concerning Protection and Development of the Environment has a single article (Article 12) that specifically deals with animals and mentions that owning, hunting, transporting and selling of species referred to in “the list” is forbidden or is subject to licence/permit from the competent authorities. The list of species protected under this law has yet to be compiled.
- The Gulf Cooperation Council (GCC) agreement is an agreement drafted for the preservation of wildlife and the conservation of its natural habitats in the Arab Gulf states of the GCC. The agreement has yet to be signed and implemented; however, once en-



**Fig. 12.** Goats are competing with tahr for grazing ground (camera trap picture of BCEAW).

forced it would cover many issues of wildlife conservation and protection. There are no CITES laws prohibiting international trade in any of the endemic prey species i.e. gazelle and tahr. The Arabian gazelle was included in Appendix 3 of CITES in April 1976 but was deleted from this category the following year in July.

The only UAE hunting law that exists is the Federal Decree – Law No. 9 for 1983; Regulating the Hunting of Birds and Animals. The law states the following: “This law protects certain species of birds, deer of various kinds, wild cows, hares and Mastigures (spiny-tailed lizards).” Gazelle and tahr could be classified into one of the categories mentioned; however, confirmation has not been possible.

**Conflicts and public awareness**

The leopard will on occasion prey on domestic livestock (Gasperetti *et al.* 1985). There are no confirmed records of the frequency of such killings in the UAE; however, the leopard or “nimr” is most often blamed for the kill. As mentioned previously, a survey amongst local farmers revealed that less than half the people questioned had ever even seen a leopard, however, nearly all the farmers said that they would not hesitate to kill any predator they encountered. Field notes by R. Llewellyn-Smith in 1999 (Jongbloed 2001), describe the sentiment of two mountain residents as “relieved that there were no leopards left,

as they are devils”.

Moaz Sawaf recounted a leopard sighting on June 13, 1996 by a local tribesman in Wadi Zeebat (Jongbloed 2001). As a result of contact with Moaz and the ALT; the tribesman did not shoot the male but rather watched it through binoculars for ten minutes. His parting comment to Moaz was that he would not mention this incident to his friends as they may arrange a hunting party in order to try to shoot the leopard.

During the survey conducted on behalf of Chris and Tilde Stuart by Moaz Sawaf in 1995 it was revealed that only 50 % of the farmers knew of any laws banning hunting. Of the farmers inter-



**Fig. 11.** Rock hyrax, a potential prey species for leopards in the Jebel Hafit (Photo J. Edmonds).

viewed 44 % did not feel obliged to obey such a law and would hunt as they pleased, 94 % felt it was quite acceptable to kill leopards and 81 % said they would hunt a predator actively whether or not it threatened their herds.

Until their closure in 2001, the ALT was extremely active in promoting conservation within the UAE and maintained the Arabian leopard as their flagship species. The organisation was instrumental in organising fund raising events throughout the eight years that they were active.

A children's story called "Hayat the Arabian leopard" written by Marycke Jongbloed sold 5,000 copies in English. The story was serialized in "Young Times", the children's section of a local newspaper. An Arabic version of the book was printed and distributed at schools in the UAE, sponsored by ERWDA (Environmental Research and Wildlife Development Agency).

A series of postage stamps depicting the four wild cat species of the UAE was issued by the General Postal Authority on October 10, 1994. The leopard has been featured on UAE telephone cards.

The release of an educational video, "Land of the Nimr" during 1997 in both English and Arabic, sponsored by Shell and produced by World Wildlife Production included information about the Arabian leopard and the efforts being made to save it.

The BCEAW, Sharjah has designed and regularly updates an informative web page, focusing on all endemic Arabian wildlife ([www.breedingcentres-sharjah.com](http://www.breedingcentres-sharjah.com)). This is an ongoing educational tool that has been implemented since 1999.

The BCEAW, Sharjah organises an annual Conservation Workshop for the Fauna of Arabia on behalf of the Environment and Protected Areas Authority. These workshops have encouraged co-operation between conservation institutes on the Arabian Peninsula and have also provided international exposure of conservation efforts within the region. Through the workshops, numerous surveys have been initiated and the captive breeding program for Arabian leopard has become a co-operative ex situ conservation aide.

Arabia's Wildlife Centre at the Sharjah Desert Park has a unique public dis-

play of fauna endemic to Arabia. Each display has general information lecterns providing basic details about the animal and its habits. Large species, including the Arabian leopard have audio facilities giving interesting facts in English and Arabic.

### People and institutions

The Environment and Protected Areas Authority (EPAA) of the Sharjah Government supports and funds the BCEAW and research work carried out at the centre.

World Wildlife Fund (WWF) operates at a Federal level to address conservation priorities. There are five main priorities that the WWF presently focus on, namely 1) marine environment, 2) species of special concern (for the UAE and globally), 3) freshwater environments, 4) climate changes and 5) toxic and chemical threats.

The Environment Agency - Abu Dhabi (EAD) formerly known as the Environment Research and Wildlife Development Agency (ERWDA) is a government funded organisation based in Abu Dhabi. EAD conducts wildlife research and regional surveys of Abu Dhabi. The agency does not have any direct involvement in leopard projects at this stage.

Dubai Natural History (DNH) group and Emirates Natural History Group (ENHG) are non-government wildlife awareness groups that organise regular field excursions, wildlife awareness lectures and monthly newsletters. The Emirates Environmental Group (EEG), based in Dubai, is actively involved in promoting environmental awareness in and around Dubai. The group focuses on wildlife awareness and practical environmental goals such as recycling waste etc. Student workshops and Interschool environmental competitions are some of the activities also organised and promoted by the EEG.

No universities are actively involved in leopard conservation in the UAE although the American University of Sharjah has recently formed a student conservation group.

### Ongoing work and research projects

There is currently no monitoring system specifically targeting the occurrence of Arabian leopard within the UAE. Staff

at the BCEAW, Sharjah conducted an intensive 24-month monitoring project of the Arabian tahr between June 2000 and January 2002. The survey was conducted with the use of camera traps and observers in the field. The monitoring site is located within prime leopard habitat in the Shumayliya Mountains along the east coast of the UAE (see map). As mentioned previously, the survey project only produced 13 photographs of tahr which represents 2.1 % of the total number of photographs taken. All the photographs of tahr were of females and offspring. 1.6 % of the photographs were of Arabian caracal, 2.2 % of the photographs were of Sand partridge, Red fox appeared in 0.3% of the photographs and hedgehogs occurred in 2.8% of the photographs. The vast majority of the photographs (64.7 %) were of feral goats. Surprisingly, with 26.4 % occurrence, Blanford's fox was photographed more commonly than any of the other endemic species.

The Arabian Tahr Conservation Group (ATCG) plans to implement an extensive survey of the UAE in 2006/2007. The presence/absence of leopard is likely to become apparent through this survey.

The BCEAW, in conjunction with Henry Doorly Zoo, Omaha, USA initiated genetic research to determine whether there are in fact two distinct forms of the sub-species *Panthera pardus nimr* within the region. Initial findings indicated that there is no evidence to support species differentiation between northern and southern leopards, however the sample size was extremely small. Further investigation is required with a larger set of samples to substantiate these findings, with particular focus on northern specimens as only 3 samples were available. Further genetic identification is in progress in collaboration with Carlos Fernandes at Cardiff University, UK.

The collection and analysis of morphological data from captive specimens is ongoing at the BCEAW. The data provides an average range of measurements with which to describe the subspecies.

The BCEAW, Sharjah sponsored and supported research into the reproductive physiology of the Arabian leopard which forms the thesis for a PhD at Cambridge University. The aim of

the thesis is threefold 1) to establish the normal reproductive physiology of the Arabian leopard, 2) to address infertility in the captive Arabian leopard in terms of incidence and cause and 3) to assess the potential use of assisted reproductive physiology in captive breeding including semen banking and control of the oestrus cycle for artificial insemination, oocyte retrieval and embryo transfer. Data collection has now been completed and the results compiled (de Haas van Dorsser 2006).

### Recommendations

Knowledge of the distribution, population size, biology/ecology and behaviour of the Arabian leopard is still very limited. Further research is essential in order to plan effective conservation approaches. Accurate data regarding the distribution, ecology and behaviour of the Arabian leopard will enable protected areas to be planned and proposed.

Correct management and representation of the captive breeding programme already established will ensure an important genetic "reservoir" that can be used to supplement and improve increasingly threatened wild populations throughout the Arabian Peninsula. Of extreme importance is improved cooperation between the range states of the peninsula to provide the largest possible founder population on which to build the captive genetic pool.

Improved legislation and enforcement protecting the leopard and its prey species from trade (national and international) will ensure both long and short-term conservation strategies are successful.

According to Ogada *et al.* (2003) traditional livestock husbandry practices similar to those used in Kenya can make an important contribution to carnivore conservation. Livestock that is closely herded by day and corralled at night are less likely to be killed by wild predators. Fewer predators would be killed where fewer predators kill livestock (Ogada *et al.* 2003). Implementation of low cost herding practices among local farmers and education regarding the benefits of herding and corraling of livestock would contribute to reducing human-predator conflicts.

### Inventory

There are no museum collections known within the UAE.

22 animals are kept in captivity: 20 (12 M, 8 F) at BCEAW, Sharjah, and 2 (1 M, 1 F) at Nakhlee Estate, Dubai.

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### References

- CBSG Conservation Breeding Specialist Group (SSC/IUCN). 2000. Conservation Assessment and Management Plan for Arabian Carnivores and Population and Habitat Viability Assessment for the Arabian Leopard and Tahr: Final Report. Conservation Breeding Specialist Group, Apple Valley, MN.
- CBSG Conservation Breeding Specialist Group (SSC/IUCN). 2001. Conservation Assessment and Management Plan (CAMP) for the Arabian Leopard and Arabian Ungulates with Population and Habitat Viability Assessments for the Arabian Leopard, Arabian Oryx, and Tahr reports. Arabian leopard: Action Plan and Reports. Conservation Breeding Specialist Group, Apple Valley, MN.
- CITES. 1998. Checklist of CITES Species. CITES Secretariat, Geneva World Conservation Monitoring Centre, Geneva, Switzerland.
- De Haas van Dorsser F. J. 2006. Reproduction in the Arabian leopard. PhD Dissertation, University of Cambridge, Newnham College, Cambridge, UK.
- Drew C. 2000. The distribution of the Cape Hare, *Lepus capensis*, in Abu Dhabi Emirates, United Arab Emirates. *Zoology in the Middle East* 20:15-20.
- Environment and Protected Areas Authority. 2002. Conservation Assessment and Management Plan for the Threatened Fauna of Arabia's Mountain Habitat. Arabian leopard (*Panthera pardus nimr*) Group Report. Breeding Centre for Endangered Arabian Wildlife, Sharjah, UAE.
- Environment and Protected Areas Authority. 2003. Conservation Workshop for the Fauna of Arabia. Breeding Centre for Endangered Arabian Wildlife, Sharjah, UAE.
- Environment and Protected Areas Authority. 2004. Conservation Workshop for the Fauna of Arabia. Breeding Centre for Endangered Arabian Wildlife, Sharjah, UAE.
- Environment and Protected Areas Authority. 2005. Conservation Workshop for the Fauna of Arabia. Breeding Centre for Endangered Arabian Wildlife, Sharjah, UAE.
- Environment and Protected Areas Authority. 2006. Conservation Workshop for the Fauna of Arabia. Breeding Centre for Endangered Arabian Wildlife, Sharjah, UAE.
- Gasperetti J., Harrison D. L. and Büttiker W. 1985. The Carnivora of Arabia: Fauna of Saudi Arabia 7, 397-461.
- Harrison D. L. 1971. Observations on some notable Arabian mammals, with description of a new gerbil (*Gerbillus*, Rodentia, Cricetidae). *Mammalia* 35, 111-125.
- Harrison D. L. and Bates, P. J. J. The Mammals of Arabia. 1991. Second edition. Lakeside Printing, Sevenoaks, Kent, UK Pages 167-170.
- Hellyer P. 1993. A summary of recent lynx and leopard sightings in the northern UAE and Musandam. *Tribulus* 3, 23-24.
- Jongbloed M. 2001. Working for Wildlife. Barkers Trident Communications, London, UK. 96 pp.
- Muir-Wright M. T. 1999. The Diet of the Highly Endangered Arabian Leopard (*Panthera pardus nimr*). Thesis for BSc Honors Zoology degree from the University of Aberdeen, UK.
- Nowak R. M. and Paradiso J. L. 1993. Walker's Mammals of the World. 4th Edition. Volume 2. The John Hopkins University Press, Baltimore and London. Pp 1089-1091.
- Ruddock L. 2002. Report on fieldwork in the Shumayliyah Mountains, UAE for the period January 2001 to January 2002. Breeding Centre for Endangered Arabian Wildlife, Sharjah, UAE.
- Ruddock L. and Smith M. 2002. Arabian tahr: Disappearing from the Hajar Mountains of the UAE? Breeding Centre for Endangered Arabian Wildlife, Sharjah, UAE.
- Skinner J. D. and Smithers R. H. N. 1990. The Mammals of the Southern African Subregion. University of Pretoria, Pretoria, Republic of South Africa.
- Spalton J. A. and Willis D. 1999 The Status of the Arabian Leopard in Oman: First Results of the Arabian Leopard Survey. In *The Natural History of Oman: A Festschrift for Michael Gallagher*, Backhuys Publishers, Leiden. Pp 109-127.
- Stuart C and Stuart T. 1995. Minute to Midnight. Report of a scientific survey on the status of indigenous wildlife in the United Arab Emirates executed on behalf of the Arabian Leopard Trust.
- Stuart C. and Stuart T. 1995. Mammals of the UAE Mountains. *Tribulus* 5.2, 20-21.
- Thesiger W. 1949. A Further Journey across the Empty Quarter. *The Geographical Journal* 113, 21-44.