Status Report on Arabian Leopard in Yemen

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The assumption that the historical range of the leopard in Yemen formerly extended through all or most of the mountainous areas of the country seems to be reasonable. Since 1990 reports on the occurrence and distribution of the Arabian leopard in Yemen are generalized, and all post 1990 records can be grouped in five broad clusters. 1. The northern part of the western highlands (Wada'a, Saada to the Saudi border and Kufl Shammar in Hajja. 2. The central part of the western highlands (Al Hayma, Jebel Bura'a and Jebel Raymah. 3. South western region (Radfan to Al Koor and possibly extending west to Taizz). 4. Central Yemen (Wadi Hajar, possibly with Wadi Hadhramaut). 5. Al Mahra region in the East.
Due to lack of sufficient information on various aspects of the leopard's life in Yemen, extensive field work is urgently needed to assess the status of this animal. Since the animal is facing great threat, strict protection measures are urgently needed. Major threats to leopards include 1. depletion of their prey, 2. direct persecution through killing, 3. habitat degradation. Immediate action to control these threats are needed, priorities are:1. Establish the current status of the leopard and its prey. 2. Provide effective protection for the Arabian leopard and its prey. 3. Take immediate protection measures once surveying sub-populations are identified. 4. Set up an Arabian Leopard Working Group to develop a conservation strategy. 5. Develop a good captive breeding programme. 6. Initiate long term education and public awareness. 7. Strongly discourage further live capture and hunting.

إن الافتراض بأن انتشار النمر العربي في اليمن قد امتد في كل أو معظم المناطق الجبلية يبدو أمرا مقبولا. فجميع تسجيلات تواجد وانتشار النمر العربي التي ظهرت في التقارير منذ العام 1990 هي معلومات عامة، أما التسجيلات التي ذكرت بعد 1990 فيمكن وضعها في خمس مجموعات رئيسة. 1- المنطقة الشمالية للمرتفعات الغربية (وادعة وصعدة امتدادا إلى الحدود السعودية ووصولا إلى قفل شمر في حجة). 2- الجزء الأوسط من المرتفعات الغربية (الحيمة وجبل برع وجبل ريمة). 3- المنطقة الجنوبية الغربية (من ردفان إلى الكور مع احتمال امتدادها غربا إلى تعز). 4- المنطقة الوسطى (وادي حجر ومن المحتمل وادي حضرموت). 5- منطقة المهرة التي تقع شرق البلاد.
نظرا لعدم توفر معلومات كاملة عن مختلف جوانب حياة النمر العربي في اليمن فإن الحاجة ملحة للقيام بدراسات حقلية لتحديد الوضع الحالي لهذا الحيوان. ونظرا لأن النمر يواجه تهديدات كثيرة فإن هناك حاجة ملحة لاتخاذ التدابير اللازمة لحمايته بالسرعة القصوى، و تشمل التهديدات الرئيسة ما يلي: 1- اصطياد الحيوانات التي يتغذى عليها النمر في الطبيعة، 2- القتل المباشر للنمر، 3- تدهور البيئات التي يعيش فيها. وللسيطرة على هذه المهددات بالسرعة المطلوبة فإنه يجب تطبيق الأولويات الآتية: 1- تحديد الوضع الحالي للنمر ولفرائسه. 2- توفير الحماية له وللحيوانات التي يفترسها.. 3- اتخاذ سبل الحماية الضرورية بمجرد تحديد تجمعاته الثانوية. 4 - إنشاء مجموعة عمل من المتخصصين لوضع استراتيجية الحماية. 5- تطوير برامج الإكثار في الأسر. 6- البدء ببرامج تعليم وتوعية بعيدة المدى. 7- عدم التشجيع باصطياده.

Status and Distribution

Information on the historical distribution of leopards *Panthera pardus nimr* in Yemen is sparse and fragmentary, with only a small number of specific records. Nevertheless, it is generally assumed that the historical range of the leopard in Yemen extended through all the mountainous areas of the country, from the Saudi border south along the western escarpment, then east to the border with Oman. The linear distance measures around 500 km from north to south and a further 900 km from east to west and represents a potentially extensive area of former range.

Some reports relate to skins purchased in markets that have only a vague place of origin. Caution is additionally needed because skins and live animals of many species have traditionally been imported from northeast Africa into Yemen. For example Hunter (1877) referred to leopard skins imported into Aden for sale to ship passengers. Morrison-Scott (in a footnote to Thesiger 1949) said that two Arabian leopard skins he examined were 'a good match' for one from So-

malia, so differentiating skins of Arabian leopards from those originating in northeast Africa may be difficult.

Harrison (1968) quoted an early sight record in1843 and listed four specimens obtained at localities north and northeast of Aden. These were: west of Beihan; Jebel Dasha near Dhala; Mahfid; and the Aulaqi Kaur. In the same general area, Bury (1911) reported hearing a leopard in Wadi Hatib, between Nisab and Dathinah. Thesiger (1949) observed leopard tracks in Wadi Makhya, north of Wadi Hadhramaut. Scott (1942) saw a captive animal in Sana'a and obtained a skin said to have been procured locally; he also mentioned a leopard recently captured in the vicinity of Ta'iz. Sanborn & Hoogstraal (1953) described leopards as 'scarce but widespread' in the highlands of western Yemen, and Harrison (1968) said this also applied to their status in the mountains north of Aden.

Obadi (1993a, b) said that leopards occurred from Habil Jabr, east of Radfan, to the Al-Kaur mountains in Abyan province and reported that 22 leopards had been killed there during 1979-86 by villagers around Lawdar. This area described covers about 180-200 km, east to west, and lies north-east and east of Aden. Some of the specimens listed by Harrison (1968) were also obtained in this region.

Evans (1994) said that leopards were rare in the hills surrounding Wadi Hajar in central-southern Yemen. Jennings (1997) reported four leopards shot in the previous few years in southern and eastern Yemen, without giving detailed localities.

El-Mashjary (1995) and Lagrot & Lagrot (1999) provided recent records from Wada'a, an area situated about 120km north of Sana'a and containing 20 villages, the largest of which is Al-Gasem (16^{0}00'N/43^{0}57'E, 2,380 m). Leopard records consisted of field signs, livestock killed and leopards trapped. Several leopards have been captured subsequently in Wada'a, the latest one in early 2005 (Galal Al Harogi pers. comm.), indicating continued occurrence there.

Recent survey work carried out by one of the authors [AKN] in Bura'a protected area found no signs or local reports of leopards. A field survey in May 2005 in part of Wadi Hadhramaut revealed that the last leopard had been shot about 15 years earlier and some local people who were questioned did not know the animal (EPAA 2005).

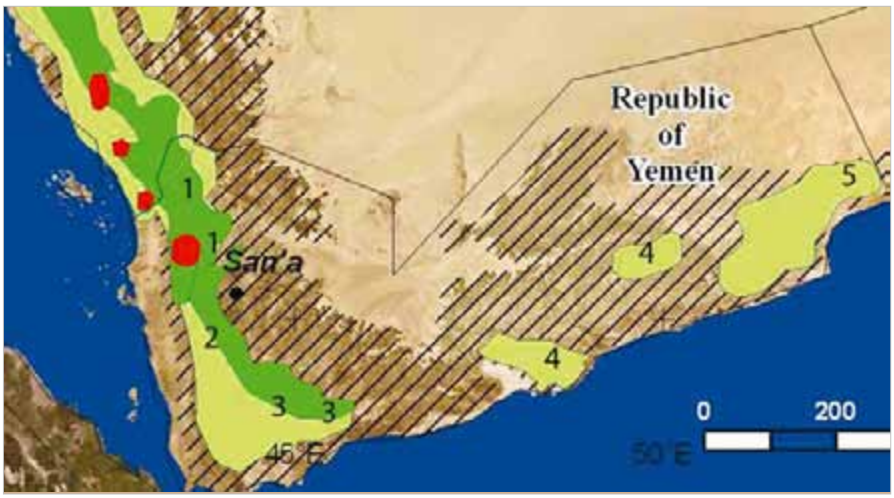

Fig. 1. Distribution of Leopards in the Republic of Yemen. For the numbers in the map, see text.

According to local reports collated by the Environmental Protection Authority in Sana'a, leopards are present in seven localities: between Sa'dah and the northern border with Saudi Arabia; Kufl Shammar, in Hajjar Governorate; Al Hayma, east of Manakhah; Jebel Bura'a and Jebel Raymah; between Ta'iz and Aden; Hadhramaut; Al Mahra.

It is difficult to give an accurate summary of current leopard status in Yemen, given the absence of recent survey data. However, all the above post-1990 records and reports can be grouped into five broad geographical clusters (Fig. 1):

1. The northern part of the western highlands (Wada'a, Kufl Shammar, and the area between Sa'dah and the Saudi border).
2. The central part of the western highlands (Al Hayma, Jebel Raymah, and possibly Jebel Bura'a).
3. Southwest Yemen. This comprises the area from Radfan to Al Kaur, as described by Obadi (1993a, 1993b), and possibly extending northwestwards to mountains in the vicinity of Ta'iz. It is possible that some of the captive leopards held in Ta'iz zoo came from a nearby locality.
4. Central-southern Yemen (Wadi Hajar and Hadhramaut). It seems likely that leopards have been extirpated from the central part of Hadhramaut. However, the lower part of this huge wadi system, Wadi Masilah, has not yet been surveyed for large mammals. It is remote, largely uninhabited and contains a 130-km long stretch of flowing water (F. Krupp, pers. comm.). There is also no recent information from the wadis north of Hadhramaut such as the area around Minwakh and Zamakh where ibex are reported to be present.
5. Al Mahra, in eastern Yemen. Hauf Forest and nearby mountains share similar habitat to that in the adjacent mountains of Dhofar. Leopards have been recorded in Oman within a few kilometres of the border (Spalton *et al*. 2006) and ibex are reported to occur on the Yemen side (Evans 1994. Showler 1996).

However, the above reports vary in data quality and may be out of date. It is likely that some or even many of theses sites no longer hold leopards, or that only small remnants survive. In fact, the only site where leopard presence has been definitely confirmed during the last two years is Wada'a. This is a relatively small area and one where leopards have been regularly trapped. Un-notified trapping must surely at least equal the number of reported cases. Removal of animals from the wild, either live captured or killed, cannot be sustained indefinitely. Field work is urgently needed to assess the status of leopards in each of these areas and the extent of isolation between them.

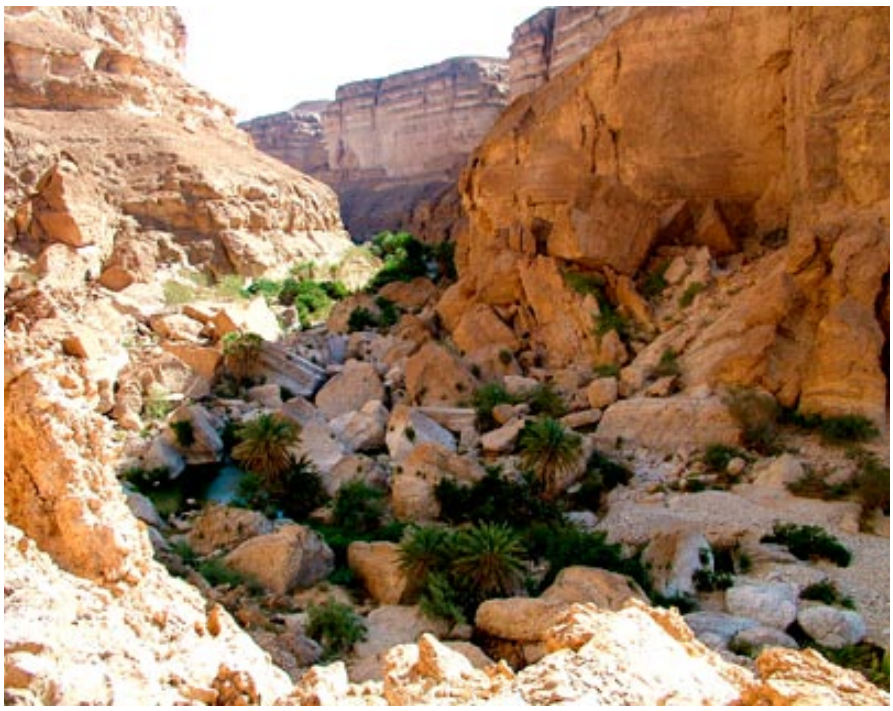

Fig. 2. Wadi Hadhramout in Yemen (Photo P. Vercammen).

There are no estimates of past or present numbers, but the population is generally considered to be small and fragmented. The few published sources agree that leopards are rare in Yemen. El-Mashjary (1995) said that large mammals had been seriously depleted during the 20th century and that leopards were rarely seen. Stuart & Stuart (1996) suggested that leopard numbers were very low. Al-Jumaily (1998) said that leopards could be close to extinction. The current population trend is assumed to be declining, based on reductions in prey species and the scarcity of reports.

Threats

The major threats to leopards in Yemen are direct persecution and depletion of the prey base through uncontrolled hunting. Firearms are widely available, wildlife is heavily hunted and populations of all large mammals have declined in recent decades (Varisco *et al.* 1992, El-Mashjary 1995, Al-Jumaily 1998, UNDP/UNEP/GEF 2001).

Leopards are killed and trapped by livestock owners in some areas. Obadi (1993a, 1993b) reported that villagers in the Lawdar area had killed 22 leopards during 1979-86 in retaliation for attacks on goats and he saw skins of five leopards. He also reported that people in Umdrib village had killed three leopards during one night in June 1983. These were presumably a female with two cubs. Figures from Wada'a are divergent. El-Mashjary (1995) said more than 100 leopards had been trapped by shepherds in Wada'a over the previous 20 years to protect their livestock, while Lagrot & Lagrot (1999) quoted the local sheikh as saying that 10 leopards (9 males, 1 female) had been caught during the last 10 years. Leopards are captured in stone traps called *margaba*. The traps resemble an igloo in shape, 120cm high and 200cm long, with a long flat stone suspended above the entrance by a rope, which is attached to a piece of meat at the far end of the trap. Eight traps were sited at the top of a cliff above the wadi, and close to the inhabited area. Some of the leopards caught in this area have ended up in captivity, while others have been killed; their fat and skin may be used as medicine against rheumatism and skin disease (El-Mashjary 1995, Lagrot & Lagrot 1999). Leopards are still being captured here occasionally including one in spring 2005.

There has been a tradition of exhibiting captive leopards in towns in Yemen. Hunters still occasionally catch leopards for trade purposes and according to anecdotal reports, the price for a captive Arabian leopard may have risen to US$15,000. Three leopards from Yemen were sold in Saudi Arabia in 2001 (Judas *et al*. 2006). It is impossible to estimate accurately the number of leopards captured and sold or exported. Increasing public awareness work may be having some effect in limiting the extent of illegal killing and live capture.

Habitat degradation and destruction also affect much of the country. Overgrazing, unrestricted cutting of forests and scrub for fuel and building, and a growing human and livestock population increasingly impact upon the environment and pose a threat to terrestrial biodiversity in general (Varisco *et al*. 1992, UNDP/UNEP/GEF 2001).

As sub-populations become smaller and more isolated, movement of individuals between them, and thus gene flow, is increasingly restricted and dispersal distances grow larger. Such demographic factors will gain in significance as leopard numbers become further depleted.

Habitat

The western mountains extend for over 500km from north to south and parallel to the Red Sea. These mountains rise steeply from the Tihamah coastal plain and contain many peaks over 3,000 m in elevation, including Jabal al-Nabi Shu'ayb (3,666 m), the highest point on the Arabian Peninsula. The central part of the range consists of hills and basins at altitudes of 2,000-2,750 m that fall away gradually on the eastern side to the desert interior. The western escarpment is intensively cultivated, usually by means of extensive terraces and it is cut by numerous, deep valley systems. The seven largest wadis contain water throughout the year and are partially wooded with trees and shrubs such as *Cordia abyssinica*, *Breonadia salicina* and *Ficus* species (Scholte 1992). Wadi Rijaf has luxuriant riparian forest with trees up to 20mб including species of *Ficus*, *Mimusops*, *Tamarindus*, and *Trichilia* (Cowan 2004). The mountains become more rounded to the south around Ta'iz. Natural vegetation here has been extensively degraded, but some *Euphorbia ammak* scrub occurs in the southern part of the escarpment (Cornwallis & Porter 1982) and a few pockets of juniper woodland (*Juniperus* spp.) remain, for example on Jabal Iraf, between Aden and Ta'iz (Martins 1996).

Wada'a, in the northern part of the western highlands was described by Lagrot & Lagrot (1999) as a dry, rocky mountain with two wadis several kilometres apart and covering about 600 km^2. El-Mashjary (1995) said the area contained 20 villages and a steep rocky gorge.

A series of arid mountains, hills and plateaux extends across southern Yemen. Rugged hills and mountains with peaks above 2,000 m run eastwards along the interior of southern Yemen to the northeast of Aden. An extensive, barren desert plateau, around 1,000-1,200 m in elevation, the *jol*, extends eastwards from Shabwa, dropping away northwards to the sands of the Rub al Khali. This plateau is deeply dissected by a complex series of wadis, some of which contain permanent water. The longest and most extensive of these is the Wadi Hadhramaut-Wadi Masilah system, which runs west-east then southeast into the Gulf of Aden. Former leopard habitat in Wadi Hadhramaut consists of deep wadis incised into the plateau with long stretches of cliff and blocks of fallen rock. Drier slopes hold a sparse vegetation of *Acacia* spp., *Lycium shawii*, *Zizyphus* spp. In the wadi beds a few permanent fresh water pools and springs occur along with pools of a temporary nature: location and duration of the latter vary with rainfall. These are surrounded by groves of trees including figs (*Ficus salicifolia*, *F. populifolia* and date palms *Phoenix dactylifera*. Hauf Forest in Al Mahra Governorate is dominated by *Anogeissus dhofarica*, *Commiphora habessinica* and *Adenium obesum* (Martins 1996).

Forest cover in general was once much more extensive than at present, but trees have been systematically cut down for fuel over the centuries, and forests are now almost absent, except for the 30,000 ha Hawf Forest in Al Mahra and 4,100 ha Bura'a Forest in Al Hudaidah. Scattered *Acacia* and *Commiphora* savanna woodland occurs sporadically along the coast and in some inland areas, but rapidly thins out eastwards into the desert.

The climate is generally hot, though modified by altitude. Frost and snow are not uncommon in winter at high elevations (Cornwallis & Porter 1982). Precipitation may reach 650 mm annually in the western highlands, with rainy periods in spring and summer. Southern and eastern Yemen are much hotter and more arid, except for the extreme east where there is a short summer rainy season.

Fig. 3. Bura'a in the western mountains of Yemen (Photo A. K. Nasher).

Prey Species

There is no information on leopard diet in Yemen but several potential prey species occur. Nubian ibex *Capra nubiana* have a scattered distribution in southern and eastern Yemen (Al-Jumaily 1998, Evans 1994, Showler 1996, UNDP/UNEP/GEF 2001). However, as long ago as 1915 the ibex was considered rare and had already disappeared from some areas of former range (Harrison 1968). Ibex are still distributed across southern Yemen but numbers have been depleted by hunting. In Hadhramaut there is a long tradition of ibex hunting and horns are traditionally placed on the corners of houses. Ibex are still present in Hadhramaut but numbers have fallen to low levels. Mountain gazelle *Gazella gazella* is the only widespread gazelle species whose range overlaps that of the leopard to a significant degree. Arabian sand gazelle *Gazella subgutturosa marica* prefers sand dune habitats and has only been recorded in the north and northeast, so its range is unlikely to overlap that of the leopard. Two other species, *Gazella bilkis and G. saudiya*, are extinct. All gazelle populations in Yemen have been severely depleted by overhunting (Mallon & Al-Safadi 2001).

Hamadryas baboons *Papio hamadryas* occur in the western mountains and highlands northeast of Aden (Harrison & Bates 1991, Al-Jumaily 1998). However, it has not yet been established that Arabian leopards, which are very small in size for this species, actually prey on baboons. Gasperetti *et al*. (1985) observed that baboons living in social groups would be a formidable prey, and suggested that leopards would only be able to take them on rare occasions when an individual baboon became isolated.

Several medium-sized mammals that were recorded in leopard diet in southern Oman by Muir-Wright (1999) are widely distributed in Yemen: Rock hyrax *Procavia capensis*, Cape hare *Lepus capensis*, porcupine *Hystrix indica*, and hedgehogs *Paraechinus aethiopicus* and *P. hypomelas* (Harrison & Bates 1991, Al-Jumaily 1998). Small carnivores could in theory also form part of leopard diet. Species available in Yemen comprise golden jackal *Canis aureus*, three species of foxes *Vulpes vulpes*, *V. rueppellii*, *V. cana*; three cats *Felis silvestris*, *F. margarita*, *Caracal caracal*; honey badger *Mellivora capensis*; two mongooses *Bdeogale crassicauda*, *Ichneumia albicauda*, and one viverrid *Genetta feline*. All apparently occur at low densities (Harrison & Bates 1991,

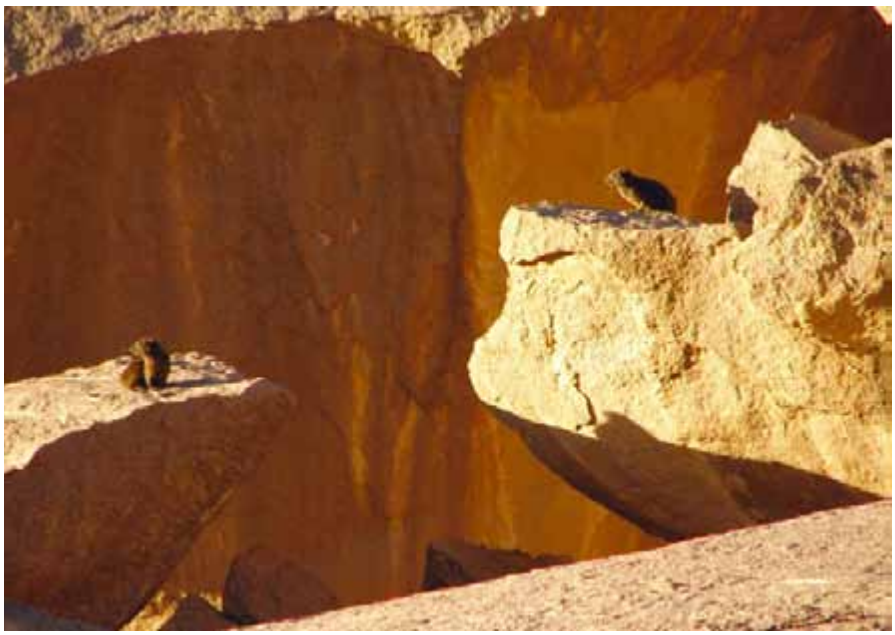

Fig. 4. Rock hyrax have been identified as leopard prey. They are widespread in Yemen (Photo Ch. Breitenmoser-Würsten).

Al-Jumaily 1998) and some do not occur in leopard habitat. It is also unclear whether these species could form a significant part of the diet or whether they would only constitute an occasional prey item. Potential prey also includes birds such as partridges *Alectoris philbyi*, *A. melanocephala* and *Ammoperdix heyi*, sandgrouse *Pterocles* spp. and other ground-living birds, as well as larger reptiles such as *Uromastyx* spp. Leopards are known to prey on livestock but there are few details on the frequency of attacks or extent of depredations.

Domestic Animals

Livestock are an integral part of the rural economy. Sheep and goats are kept everywhere, with smaller numbers of camels, donkeys, and horses. Camels are more frequent in the south and drier parts of the interior. Leopards are known to prey on livestock on occasion but there are few details on the frequency or the impact of these attacks. There are no analyses to show the extent of leopard predation on domestic animals.

Local people in Wada'a said that leopards began to attack livestock once gazelles disappeared, about 20 years previously, according to El-Mashjary (1995). They used to take 3-4 goats a month, but on one occasion a leopard killed 45 goats in a single attack. (Obadi (1993a, b) reported retaliatory killing of leopards by shepherds in the Lawdar area. There is no government compensation scheme for livestock losses, though at least one local leader is reported to operate a private scheme. Numbers of domestic animals are increasing, along with the human population.

Legal Status

The leopard and its prey species are legally protected, but enforcement is weak or lacking, especially in remote areas. Several protected areas in Yemen have been proposed and two are being implemented (UNDP/UNEP/GEF 2001). Wadi Rijaf PA in the western highlands contains hamadryas baboon, porcupine and striped hyena, but leopards probably no longer occur (Cowan 2004). Bura'a Protected Area is also situated in the western highlands. Hawf Forest on the eastern border may contain leopards but their presence needs confirmation. An ibex reserve has been proposed in Wadi Hadhramaut, where leopards were last recorded up to 15-20 years ago.

Conflicts and Public Awareness

Some villagers believe that leopards pose a threat to their livestock and El-Mashjary (1995) quoted local people in Wada'a as saying that leopards are aggressive and dangerous.

Work to raise awareness of the plight of the leopard is increasing. Several posters on various aspects of Yemen's biodiversity including leopards and prey have been produced by the Sharjah Environment and Protected Areas Authority (EPAA) and distributed in cooperation with the Environmental Protection Authority.

People and Institutions

The Environmental Protection Authority (EPA) is the government agency responsible for co-ordinating wildlife research, environmental education and legislation. The Biology Department of the University of Sana'a has conducted some mammal surveys of Yemen. NGOs involved in the conservation of wildlife include the Yemeni Biological Society, established in 2001, and the Yemen Society for the Protection of Wildlife (or Wildlife Yemen), founded in 2002.

Ongoing Work

EPA collects local reports of leopards. A programme of cooperation between EPA and EPAA Sharjah has included production of publicity materials, assistance with captive breeding, field surveys and training. A preliminary investigation of Hauf Forest by a joint Yemeni-Omani team took place in May 2006 and further work is planned.

Nine leopards are currently held at Sana'a and Ta'iz zoos. Breeding took place at both zoos in 2003 but the young died in both cases, as well as one adult in Sana'a. Successful breeding took place at Sana'a zoo in 2004. Veterinary assistance and management advice and training have been provided to Sana'a Zoo by the Breeding Centre for Endangered Arabian Wildlife, Sharjah. Some captive animals have been sent from Sana'a to BCEAW to take part in the captive breeding programme, and are entered in the international studbook.

Recommendations

Action is needed at all levels to conserve the Arabian leopard and its prey in Yemen. The highest priority for action is a programme of field surveys to establish current distribution and status. This information is fundamental to the development of a comprehensive conservation programme.

Field surveys

- Investigate at the earliest opportunity the current situation in Wada'a, the

only site where leopards are known to exist at present. Information required includes basic habitat parameters; numbers of leopards trapped; the frequency of attacks on livestock. Protection measures and awareness-raising activities should be instigated to stem further losses from the wild population.

- Conduct rapid assessment surveys in all areas where leopards have been recently reported (see above). Follow up with more detailed surveys where positive indications of leopard presence are found. Surveys should utilise the full range of field techniques to accelerate data collection: sign surveys (tracks, scrapes etc), molecular scatology, camera trapping, structured local interviews as appropriate.
- Take immediate protective measures once any surviving sub-populations are identified.
- Provide a training programme in field techniques for local rangers and staff, backed up by written materials (i.e. a basic survey handbook).

Captive Breeding

- Develop the captive breeding programme in line with the best international standards.
- Extend training in captive management and veterinary techniques to Ta'iz Zoo.
- Integrate all leopards currently in captivity, notably those in Ta'izz, into the international captive breeding programme.

Education and Awareness

- Develop a long-term education and public awareness programme through schools, posters and the media.
- Strongly discourage further live capture and hunting through all possible measures.

Ecological Research

- Collect and collate information on home range size, habitat use, dispersal, diet.

Fig. 5. Bura'a in the western mountains of Yemen (Photo Abdul Karim Nasher).

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