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Abstract: This report describes the rapid biological survey in Nayabandan Wildlife Refuge (16 - 24 May 2002) and discusses the issues pertinent to the conservation of the cheetah in this area. The very low animal densities in Nayabandan are believed to be due to the aridity of the area, caused by the severe draught of the last few years, and illegal hunting. The striped hyaena was found to be the most widespread of the larger carnivores in Nayabandan, however, this species is very unlikely to have a detrimental effect on the cheetah population. Direct killing of wildlife by people is probably the biggest threat to the cheetah and its prey populations in Nayabandan. The immediate task is the protection of the cheetah, the reconstruction of its habitat, and a sustainable and meaningful research and monitoring program of the important ecological, sociological and economic aspects.

**Report on a Rapid Biological Survey of the Nayabandan
Wildlife Refuge and Impressions of the Issues Facing Cheetah
Conservation in the Area**

May 2002.

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Executive Summary.

1. This report describes the Rapid Biological Survey in Nayabandan Wildlife Refuge (16 – 24 May 2002) and discusses the issues pertinent to the conservation of the cheetah in this area.
2. Because animals occur at such low densities it was impossible to use the Distance Sampling method for counting prey animals as had been intended. Instead all animals encountered while driving through the area were merely counted without recording the distance from the transect line. In addition track surveys of both potential prey and predators were conducted. The results of all surveys are presented in Tables 1,2, and 3 and, although preliminary, show an extremely low density of all species.
3. Time and the vast size of the area did not permit a complete survey to be made. The method of direct counting from a vehicle only gives at best a very rough indication of animal numbers and does not appear to be a viable monitoring option in Nayabandan. Aerial surveys could be considered and track surveys of both predators and prey may also be worth pursuing in more detail than time permitted during this survey.
4. It is very important to set up a systematic prey monitoring program in order to understand cheetah population dynamics and movements and to measure the effectiveness of any management strategies implemented. A workshop should be held to design a research and development strategy, followed by an experimental period.
5. The very low animal densities in Nayabandan are believed to be due to the aridity of the area, exacerbated by the severe drought of the last few years and, possibly most seriously, illegal hunting.
6. The striped hyaena was found to be the most widespread of the larger carnivores in Nayabandan, however, this species is very unlikely to have a detrimental effect on the cheetah population. The relationship between these two species in Iran is certain to be very different from the relationship between the larger and more aggressive spotted hyaena and the cheetah in parts of Africa. Management action against striped hyaenas in order to try and improve cheetah numbers is not recommended. This would be very unlikely to make any difference to cheetah numbers and would be expensive in both time, human effort and money to carry out.
7. Domestic livestock grazing in Nayabandan appears to be fairly restricted. Camels are most widespread, and although the impact of domestic animals on the ecosystem has not been evaluated, it does not appear to be nearly as much of an issue as it is in some other protected areas in Iran.

8. Some effort has gone into maintaining, extending the season of and even creating new water points for wild life in Nayabandan. Water provision for wildlife is a common practice in many areas and not without controversy. It is important to consider that all the animals that inhabit this desert region are able to survive without drinking water. Indigenous animals that die in droughts do so mainly from starvation not thirst. The provision and maintenance of water in Nayabandan is probably not having an effect on the wildlife, either positive or negative. However, it must be born in mind that by making water available there is a risk that the area will be made attractive to domestic animals as they are dependant on water.
9. Direct killing of wildlife by people is probably the biggest threat to the cheetah and its prey populations in Nayabandan. No hunting should be permitted within the 14 000 km² Nayabandan Wildlife Refuge. Although the skills, tenacity and dedication of Mr Baham Najafi and his field staff is impressive, the area appears to be understaffed and the game guards are poorly equipped. Increasing the number of game guards, providing them with better equipment and training is essential. In addition wild life regulations and support from the government need to be sound.
10. Coupled with improved policing and law enforcement improved ecological awareness for not only local communities, but the Iranian people in general is equally important. The ecotourism potential of the cheetah and its environment is something that could be seriously considered and add value to the area for its people.
11. Because of its aridity the area will never maintain high densities of cheetahs or any species, but that is not important. It is long term viability that is. The immediate task is the protection of the cheetah, the reconstruction of its habitat, and the drawing up and implementation of a sustainable and meaningful research and monitoring program of the important ecological, sociological and economic aspects. This might best be achieved through a series of workshops.

Introduction:

In early 2002 Ms Laurie Marker invited me to be part of the CCF led Inception Mission for the Conservation of the Asiatic Cheetah. I readily agreed. On 20 April 2002 I was invited by Mr Mehdi Kamyab the UNDP/GEF Co-ordinator in I.R. Iran to take part in the Rapid Biological Field Surveys. Mr Mehdi informed me that due to administrative problems the hoped for participation in the Rapid Biological Surveys by WCS had not materialised. I indicated that I would only be able to spend about 2 weeks in Iran during May and it was decided that I should concentrate my activities in Nayabandan Wildlife Refuge. The main objective would be to conduct a baseline survey of cheetah and other large carnivores as well as their prey and to train people from the cheetah project in censusing techniques.

When I arrived in Tehran and met with Mr Alireza Jourabchian, the DOE Project Manager for the Conservation of the Asiatic Cheetah, he had a rather different viewpoint as to what my role should be. Mr Jourabchian emphasised that he did not regard the survey as a priority and was more interested in my assessment of the relationship between cheetahs and hyaenas in Nayabandan and on what I regarded as the important issues in cheetah conservation in the area.

In this report I describe the survey methods we used in Nayabandan and present the results. I then discuss the issues that I think are important with regard to the conservation of the cheetah in this area, including its relationship with the striped hyaena. A travelogue of my visit to Iran as well as summaries of some of the important discussions held is given in Appendix I.

Animal Surveys:

Methods:

The area referred to in this report as the Nayabandan Wildlife Refuge is a large and stunningly spectacular 14 000 km² desert area in the Kavir-e-Lut Desert in Central Iran. I was not able to ascertain the long-term mean annual rainfall, but I would imagine it is 100 – 150 mm. It comprises large areas devoid of vegetation, vast flat to rolling desert scrub plains cut by numerous wadis, home to Jabeer gazelle (*Gazella dorcas*), hills and foothills with desert scrub and also intersected by wadis, where Oriol sheep (*Ovis orientalis*) are found, and mountains where ibex or Persian wild goat (*Capra aegagrus*) occur.

I proposed to attempt to use the statistically robust Distance Sampling Method for counting potential cheetah prey species in Nayabandan. In this method the 90° distance from the transect line that animals are first seen must be recorded and the assumption is made that all animals on the transect line must be seen. However, after the first day in Nayabandan it became obvious that the very low density and extremely nervous behaviour of the wildlife would make the distance method impossible to use, but that it might be possible to use it for domestic animals. In the event domestic animals were

fortunately uncommon, and not enough sightings were made to be able to use the distance model. Accordingly we were forced to revert to merely counting whatever animals we sighted while driving through the area. Our transects were roads or tracks, wadis or cross-country driving.

The nature of much of the substrate made it possible to also see animal tracks, so we also incorporated track identification, of both predators and prey, as a means of documenting presence. Obviously it is sometimes difficult to positively identify tracks, particularly after strong winds, which seem to be a feature of the area, and in the middle of the day when the sun is high in the sky. We only included observation where we were able to identify the species with reasonable certainty and several indistinct tracks were excluded. From my experience of following tracks in the Kalahari sand I was impressed with the ability and accuracy with which the game guards and other DOE staff identified tracks. For the first two and a half days (17 – 19 May) three or four observers drove in a short wheel base Landrover or Toyota Hi-Lux Double Cab looking out for animals and one or two game guards followed on a motor cycle concentrating on finding tracks. In addition at each water point we searched for and noted animal tracks.

At midday on the third day (19 May) the motor bike and game guards left us. Having lost their services and recognising that counts could only give a very general picture of an extremely low density of herbivorous mammals, I decided to institute another tracking technique. I hoped that this technique would give some rudimentary baseline data on the relative abundance of the animals in different habitats and/or areas. At random points along the route we were travelling the vehicle was stopped and we searched for tracks in 10 – 20 m radius around the vehicle noting the presence of any that were identifiable.

All observations recorded, including GPS readings, were later entered into a spreadsheet and are given in Appendix III.

Results:

Summary observations of the counts are given in Table 1 and of the track surveys in Tables 2 and 3. In addition a list of birds identified is given in Appendix II

Prey:

In a total of 984 km we counted only 10 gazelle (9 adults and one lamb), 9 wild sheep (7 adults and 2 lambs), 1 ibex, 2 hares and 2 Houbara bustards. Granted that the animals were extremely shy and bolted as soon as they sensed the vehicle seemingly from as far as 1 km away, this still suggests an extremely low density of potential cheetah prey. This trend seemed to extend across other animal taxonomic groups as well. It was striking how few rodents, birds and reptiles we encountered. To illustrate this one day I counted all the birds; i.e. birds such as larks, wheatears, ravens etc we saw while driving through the area. In 72 km we only saw 33 birds 10 of which were ravens. The track surveys suggest that gazelle are the most widespread of the potential prey for cheetah and that

they may be at slightly higher densities than the counts suggested. Around Ali Abud wild sheep tracks were found at 67% of the survey points. This area is more undulating and hilly than most of the other areas we visited and also had the most vegetation.

Domestic animals were also uncommon. One large herd of domestic sheep and some goats were seen in the north of the refuge and hardly any tracks were seen. Around the small village of Ali Abud I saw a few sheep. Camels were more widespread although not in very large numbers (Tables 1,2 and 3).

Carnivores:

Cheetah:

We found what might have been a cheetah scat at Galobisheh Spring in the north west of Nayabandan (Table 2). However, by far the best evidence for the presence of cheetahs was found around Ali Abud where several tracks and scats were found (Table 3 and other observations not recorded at formal survey points – see travelogue). Although much of the area around Ali Abud is hilly and does not look like typical cheetah habitat and the extensive open steppe areas over much of the wildlife refuge look more suitable, the indications are that in fact cheetah prefer the undulating and broken habitat in this area. It could be argued that much of the research effort is targeted in this area, and this may give a biased picture of the distribution and habitat selection of cheetahs. Be that as it may, from discussions with Mr Jourabchian and the other DOE field staff there is little doubt that the cheetahs do move around in these hilly regions and that they prey on sheep. Studies of cheetah in Africa from the Serengeti Plains, Tanzania have left the impression that vast open plains are the best habitat for the species (Caro 1994). However, more recent studies in Kruger Park (Mills & Biggd 1993, Broomhall 2001) and Namibia (Marker-Kraus *et al.* 1996) have shown that they are more adaptable than is often believed and are able to hunt in quite thick bush as well as broken country. The track surveys suggest that the hilly area around Ali Abud also has a higher prey density than other areas we surveyed (Table 3). Cheetah, therefore, might be seeking the hilly areas of higher prey availability even though the habitat might not be as ideally suited to their hunting strategy as the open steppes.

Striped hyaena:

Of the larger carnivores the striped hyaena is the most widespread in Nayabandan, tracks being found at 14(54%) of the waterholes checked and at 3% of the survey points. In comparison with other carnivores hyaenas move around a lot more - being predominantly scavengers they cover large areas each night searching for carrion. For this reason the relatively high proportion of hyaena tracks found in comparison with other carnivores does not give a reliable estimate of the proportion by which hyaena outnumber other large carnivores. In similar but more productive habitat in the Kalahari Desert in southern Africa the

ecologically similar brown hyaena lives in clan territories of about 370 km² in which on average 3.2 adults live (Mills 1990). Extrapolating these figures to Nayabandan, but taking into account the much lower food availability in Nayabandan, I would predict that a striped hyaena territory will be 500 – 1000 km² in size with a similar number of inhabitants in the territory. This would give an adult striped hyaena population in the 14 000 km² wildlife refuge of about 56.

Discussion:

Prey:

Time and the vast size of the area did not permit a detailed survey to be made. For prey animals the method of direct counting from a vehicle with or without using the distance method only gives at best a very rough indication of animal numbers. It does not seem to be a viable option for monitoring prey animals in Nayabandan because of the size of the area and the extremely low density of animals. Aerial surveys could be used in this area, but there are obviously many logistical and methodological problems to be overcome before this method could be used. Nevertheless the idea is worth pursuing to at least establish whether a feasibility study is possible. One of the major advantages of aerial surveys is that it is possible to cover large areas in a short space of time. Track surveys may also be worth investigating in more detail and even a pellet count survey technique might be an option. Problems with track surveys are that the substrate is not always suitable for seeing tracks, strong winds often obliterate tracks and during the middle of the day when the sun is high tracks are difficult to find. Nevertheless it is very important to set up a systematic prey monitoring program in order to understand cheetah population dynamics and movements and to measure the effectiveness of any management strategies implemented, but it will take some time and experimentation to establish the best method. A workshop should be held to design a research and development strategy, followed by an experimental period.

Why is it that the potential prey for cheetahs and other large carnivores appears to be so low in Nayabandan? Firstly, this is an arid region of desert scrub, with large tracts devoid of vegetation. Consequently the area will never hold large populations of prey and in all probability the prey will be nomadic moving over large areas to where the erratic rainfall has fallen. In this regard the large size of the Wildlife Refuge is critical. Secondly, although this year there has obviously been quite good rain I understand that the area has experienced a severe and prolonged drought over the last few years. This has obviously impacted on prey populations. The third, and most important point is the question of hunting. Several DOE people emphasised the fact that illegal hunting of prey is still an important issue, although in recent years there has apparently been a drop off due to improved counter poaching activities and in the last 2 years only 2 people have been arrested for hunting gazelle in Nayabandan. Nevertheless, at Robot Chehel Payeh an old “kavanserai” which people still use as a temporary shelter in the south of the Wildlife Refuge, we found evidence for three gazelles having been slaughtered, one quite recently with blood stains and hair still clearly visible on the stone.

Carnivores:

Large carnivore counts and population monitoring programs are even more difficult to conduct than prey counts. Predators live at lower densities than their prey and are often nocturnal. Some success has been achieved with camera traps around Ali Abud and this is obviously a useful method with potential. At present, however, the technique is not being implemented systematically and a strategy needs to be worked out and implemented.

Table 1. Summary of counts undertaken in and around the Nayabandan Wildlife Refuge, May 2002.

Area	Date	Distance (km)	Animals counted	
			Domestic	Wild
Daranjeer Wildlife Refuge	16/5	15	2 donkey	1 gazelle
Nayabandan North	16/5	114	150 camel	
Nayabandan North	16/5	15		1 ibex
Nayabandan North West	17/5	74	11 camel, 2 donkey, 22 goat, 530 sheep	
Nayabandan North West	17/5	74		2 gazelle
Nayabandan North East	18/5	42		4(1) gazelle
Nayabandan North East	18/5	32		
Nayabandan North – Central	19/5	172		1 hare
Nayabandan Central	20/5	46	69 camel	1 gazelle, 2 bustard
Nayabandan Central _ South	20/5	101	28 camel	
Nayabandan South – Ali Abud	21/5	68		
Nayabandan South	22/5	118		7(2) sheep, 1 gazelle
Nayabandan South	23/5	91		
Nayabandan South – Ali Abud	24/5	37		1 hare
Total – Nayabandan		984	530 sheep 258 camel 22 goat 2 donkey	9(1) gazelle 7(2) sheep 1 ibex 2 hare 2 bustard

Table 2. Tracks found at water holes and counted from a motorbike.

Area	Date	Number of waterholes checked	Number of waterholes at which tracks were found	Km driven searching for tracks	Tracks found
Nayabandan North West	16/5	3	2 fox, 1 hyaena, 1 jackal		
Nayabandan North West	17/5	5	4 hyaena, 1 jackal, 1 fox, 1 cheetah?*	56	2 hyaena, 2 gazelle
Nayabandan North East	18/5	3	2 hyaena, 2 jackal, 2 camel, 1 wild sheep	42	1 gazelle, 1 wild sheep
Nayabandan North – Central	19/5	5	2 hyaena, 2 fox, 2 gazelle, 1 camel, 1 ibex	79	7 camel, 2 gazelle, 1 hyaena, 1 fox
Nayabandan Central – South	20/5	3	3 hyaena, 3 camel, 2 fox,		
Nayabandan South	22/5	3	2 camel, 1 hyaena, 1 wild sheep		
Nayabandan South	23/5	1	1 gazelle, 1 ibex		
Nayabandan South – Ali Abud	24/5	3	2 wild sheep, 1 hyaena, 1 dom sheep		
Total		26	14 hyaena 8 camel 7 fox 4 jackal 4 wild sheep 3 gazelle 2 ibex 1 dom sheep 1 cheetah		7 camel 5 gazelle 3 hyaena 1 wild sheep 1 fox

- Scat found, probably from cheetah.

Table 3. Tracks found at survey points along transects.

Region	Habitat*	No of Points	Species								
			Gazelle	Wild sheep	Hare	Porcupine	Hyaena	Fox	Cheetah	Camel	
Nayabandan Central	Open steppe	N									
		S	2	0	0	0	0	0	0	0	0
		M	8	4	0	0	0	1	1	0	5
	Wadi	S	11	2	0	0	0	0	1	0	8
		M	9	3	0	0	1	0	1	0	3
		1	1	0	0	0	0	0	0	0	
<i>Total</i>		<i>31</i>	<i>10(32%)</i>	<i>0</i>	<i>0</i>	<i>1(3%)</i>	<i>0</i>	<i>3(10%)</i>	<i>0</i>	<i>16(51%)</i>	
Nayabandan South	Open steppe	S									
		M	14	2	1	0	0	0	0	0	1
	Wadi	S	4	0	0	0	0	0	0	0	1
		S	4	2	0	0	0	0	0	0	0
		M	3	1	1	0	0	0	0	0	1
<i>Total</i>		<i>25</i>	<i>5(20%)</i>	<i>2(8%)</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>3(12%)</i>	
Ali Abud	Hills	N	1	1	0	0	0	0	0	0	0
		S	6	3	2	0	0	0	0	0	0
		M	11	0	10	0	0	2	0	1	0
	<i>Total</i>		<i>18</i>	<i>4(22%)</i>	<i>12(67%)</i>	<i>1(6%)</i>	<i>0</i>	<i>2(12%)</i>	<i>0</i>	<i>1(6%)</i>	<i>0</i>
GRAND TOTAL		74	19(26%)	14(19%)	1(1%)	1(1%)	2(3%)	3(4%)	1(1%)	19(26%)	

Cheetah – Hyaena Interactions:

One of the main issues raised during my visit was the relationship between cheetahs and striped hyaenas and the possible detrimental effects this might be having on the critically low cheetah population. It has been suggested that even a small impact by hyaenas on cheetahs might be enough to prevent, or at least slow down, cheetah population growth. Studies in the Serengeti ecosystem in Africa have shown that the spotted hyaena (*Crocuta crocuta*) may have an impact on cheetahs through predation on cubs and stealing food (Caro 1994).

I have had considerable experience with hyaenas and cheetahs in South Africa (Mills 1990, Mills a& Biggs 1993). For the purposes of this discussion there are two types of hyaena; the spotted hyaena which occurs throughout much of Africa south of the Sahara, and the brown hyaena (*Hyaena bruinea*) in Southern Africa and the striped hyaena (*Hyaena hyaena*) from East, West and North Africa and Asia; i.e. the one of concern here. The brown and the striped hyaenas are closely related with very similar behaviour patterns and ecological requirements. They are solitary and shy and live almost exclusively by scavenging, supplementing their diets with wild fruits, reptiles, insects and birds eggs and the occasional small animal that they kill themselves. In contrast the spotted hyaena is a bold and aggressive social hunter/scavenger capable of bringing down large prey and dominating smaller carnivores.

In Iran striped hyaenas may benefit from cheetahs by being able to scavenge from their kills. Indeed the remains of a kill left by a cheetah will provide a good meal for a hyaena, as the hyaena is able to utilise most of the bones and skin that the cheetah is unable to eat. However, striped hyaenas are very unlikely to make their own kills and so will not compete for food with cheetahs in this way. It is possible that a striped hyaena will chase a cheetah away from a kill, but the frequency of this happening is probably very low. Not only are encounters at kills between cheetahs and striped hyaenas likely to be infrequent, because of the low densities in which both species occur, when they do happen the odds are probably usually in favour of the cheetah. The Iranian cheetah is larger than the striped hyaena, and cheetahs are often in small groups, whereas the hyaena is solitary. In eight years of intensive observations of the larger brown hyaena in the Kalahari, a region that has higher densities of both cheetahs and hyaenas than are presently found in Iran, I only once observed a hyaena chase a cheetah which had three small cubs from a kill. In this instance the hyaena was clearly not interested in the cubs but in the carcass. For similar reasons as outlined above, the chances of a striped hyaena killing cheetah cubs are also very low. When the cubs are small and most vulnerable they are well hidden by the cheetah mother. The spotted hyaena is far more aggressive than the striped hyaena and far more likely to be a problem for the cheetah, even then they are less important in this regard than lions. As mentioned earlier in this report a false perception of the relative densities of cheetahs and hyaenas may be obtained because hyaena tracks are more often found than cheetah tracks. This is no doubt due in part to the fact that striped hyaenas move greater distances per day than do cheetahs, although actual home ranges of cheetahs may be larger.

I doubt very much that the hyaena in Iran has a detrimental effect on the cheetahs. I would not advise any management action against striped hyaenas in order to try and improve cheetah numbers, certainly not before a detailed research project on the relationship between these two species has been carried out. Besides being unlikely to make any difference to the cheetah population, any actions would be expensive in both time, human effort and money to carry out. I believe the problems facing the cheetah are of a very different nature.

Management Actions and Cheetah Conservation Issues:

Several management actions have been implemented in Nayabandan Wildlife Refuge to improve the protection of the cheetah, its habitat and associated wildlife.

Domestic livestock:

I am not sure of the details of the strategy towards domestic livestock grazing in Nayabandan. My impression was that it is fairly restricted and not nearly as much of an issue as it is in some other protected areas in Iran. I believe that small stock (sheep and goats) are excluded and mainly absent from Nayabandan except for a localised presence around Nayabandan Village and the DOE station and small village of Ali Abud, and spring and early summer seasonal grazing in a section in the north of the refuge. I understand that in the central area two camel herders have permanent grazing rights, but neither keep more than a maximum of 200 camels. Although camels are allowed over most of the refuge, I understand that recently the original Nayabandan protected area, (i.e. before it was increased in size), has been made an exclusive wild life area with no domestic livestock permitted. Obviously the fewer livestock allowed in the area the better, both from an ecological and aesthetic point of view. I was not able to evaluate the impact of domestic animals on the ecosystem.

Supplementary feeding of wildlife and water provision:

Supplementary food for herbivores is provided by DOE in the winter. This takes place on a fairly local level (I only saw one place close to Ali Abud where it has taken place), as obviously it would be impossible to do this over the entire wildlife refuge. This is obviously an emergency measure particularly during the drought. While this measure may help some animals survive it is not going to have an impact on the cheetah's prey throughout the area.

Some effort has gone into maintaining, extending the season of and even creating new water points for wild life. In the middle of the wildlife refuge two large earthen dams have been constructed for camels. Water provision for wildlife is a common practice in many areas and not without controversy. I think the important consideration here is that all the animals that inhabit this desert region must surely be independent of drinking water. My experience in the Southern Kalahari where considerable effort has gone into water provision for wildlife is that it makes very little difference. In fact we found a strong tendency for animals to concentrate in areas where water had been provided during the wet season and a movement away into areas without water in the dry

season (Mills & Retief 1984 a,b). This is because the movement of the animals was determined by food availability not water. Indigenous animals that die in droughts do so mainly from starvation not thirst. Having said this wild animals will use water when it is available and will sometimes move far to get to it. The provision and maintenance of water in Nayabandan is probably not having an effect on the wildlife, either positive or negative. However, it must be born in mind that by making water available there is a risk that the area will be made attractive to domestic animals as they are dependant on water.

Control of hunting and enhanced public awareness:

Although it was not possible to assess the impact direct killing of wildlife by people has and is having in Nayabandan, it is probably the biggest threat to the cheetah and its prey populations. Competition from domestic animals does not appear to be great, although the role of camels needs to be assessed, and all the other factors such as drought, water availability, and competition with other carnivore species are part of the natural process with which the cheetah has evolved over thousands of years. If the animals can be given a secure environment, particularly in such a large area as Nayabandan Wildlife Refuge, they must surely be able to survive as a viable population. Because of its aridity the area will never maintain high densities of any species, but that is not important. It is long term viability that is.

No hunting should be permitted within the 14 000 km² Nayabandan Wildlife Refuge. Controlling of poaching is difficult, not only because the area is so large but because of the abundance of firearms and the use of vehicles. Even though gazelle and other wildlife are at such low densities hunters can track them down in the sand then pursue them on motorbikes or from four wheel drive vehicles. Because of mining exploitation and the improving road network access to the area has improved and more people are moving around in the area. I was most impressed by the skills, tenacity and dedication of Mr Baham Najafi and his field staff. However, the area is in my opinion understaffed and the game guards are poorly equipped. Increasing the number of game guards, providing them with better equipment and training is essential. In addition wild life regulations and support from the government need to be sound (I do not know what the situation is regarding these aspects).

Coupled with improved policing and law enforcement improved ecological awareness for not only local communities, but the Iranian people in general is equally important. Finally, the ecotourism potential of the cheetah and its environment is something that could be seriously considered and add value to the area for its people. The very spectacular desert landscape of Nayabandan on its own must have great potential. In addition there is the wildlife and historical and cultural aspects. For example, reconstruction of some of the old “kavanserais” for tourist accommodation could be a drawcard. Obviously this is for the future. The immediate task is the protection of the cheetah, the reconstruction of its habitat, and the drawing up and implementation of a sustainable and meaningful research and monitoring program of the important ecological, sociological and economic aspects. This may best be achieved through a series of workshops involving all relevant stakeholders and international advisers.

Acknowledgements:

My trip to Iran was a wonderful personal adventure, not only because of the opportunity to make some sort of a contribution to the conservation of a highly endangered animal and to visit an amazing area, Nayabandan, but because of the opportunity to meet and discuss the conservation of the cheetah with so many interesting, highly motivated, knowledgeable and friendly people. Everyone I met in Iran was so friendly and helpful and served to make this trip the wonderful experience it was. I sincerely thank Mr Anoushirvan Najafi, Deputy Head, Department of Natural Environment and Biodiversity, Mr Mehdi Kamyab, the UNDP/GEF Co-ordinator in I.R. Iran, Mr Alireza Jourabchian, the DOE Project Manager for the Conservation of the Asiatic Cheetah, Mr Behzad Rahgoshai, DOE Deputy Project Manager for the Conservation of the Asiatic Cheetah, Mr Baham Najafi, Head of Nayabandan Wildlife Refuge and his game guards, Mr Mohammad Farhadinia, Director, Iranian Cheetah Society, and Mr Ali Nazarain from Tabas. I also thank Ms Laurie Marker and Ms Cynthia Olson from CCF and Mr Saen McKeown for their help.

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Appendix 1: Travelogue

Monday 13 May: I arrived in Theran at midday. Met with Mr Mehdi Kamyab in the late afternoon who reported that I was to fly to Tabas and then on to Nayabandan Wildlife Refuge early the next day. However later in the evening he informed me that the trip had been delayed as Mr Alireza Jourbachian, and Mr Sean McKeown, a cheetah expert from Dubai, who had been visiting several cheetah sites with Mr Jourbachian and Mr Behzad Rahgoshai, had just returned from Nayabandan and I was to meet them at the DOE office the next morning.

Tuesday 14 May: I met with Ali Jourbachian, Behzad Rahgoshai and Sean McKeown at the DOE Headquarters in Tehran. We discussed many aspects of the project including my role. Both Mr Jourbachian and Mr McKeown gave me their impressions of cheetah conservation in Iran. Mr Jourbachian stressed the importance of the cheetah as a flagship species and stressed that in his opinion protection is the first priority for the cheetah in Iran. Mr Jourbachian explained that he was concerned that striped hayenas were having a detrimental effect on the cheetahs at Nayabandan and expressed the wish that I look into this relationship as a priority and that he was not as concerned with a survey. I replied that I thought that it was very important to establish a survey technique for potential cheetah prey as it was critical to be able to measure in some way changes in prey abundance over time.

Mr McKeown pointed out that area in the Nayabandan Wildlife Refuge around Ali Abud that he had visited did not appear to be ideal cheetah habitat, because of the rugged and mountainous nature of the area and thought that some of the surrounding areas looked more suitable. At the least he suggested the cheetahs may move great distances and use both habitats, perhaps on a seasonal basis. I also had a brief meeting with Mr Anoushirvan Najafi, Deputy Head, Department of Natural Environment and Biodiversity.

Wednesday 15 May: I flew with Behzad Rahgoshai to Yazd, cleared security formalities and drove to Karanaq on the road to Tabas. At Karanaq we met with Mr Mollai, the Head of the Station near the Daranjeer Wildlife Refuge. He reported that over the last seven years there have only been eight cheetah sightings in the refuge. Two, seven and six years ago respectively, were of two cheetahs each time being shot. The remaining records are of live cheetahs being seen, including four in the last year. While this apparent increase in sightings is slightly encouraging it must also be asked whether such a low overall sighting frequency in this wildlife refuge does not suggest that the area does not hold a permanent cheetah population and that these animals are only passing vagrants. The main conservation issue seems to be the large number of camels, 3 000 I was told, and donkeys that graze in the area. This is made more complex by the fact that the people do have grazing rights.

Thursday 16 May: We left Karanaq at 07h45, continuing on the road to Tabas. After half an hour we entered the Daranjeer Wildlife Refuge, the road traversing the refuge for about 15 km. We saw one Jabeer gazelle and two donkeys which were flushed by game

guards on a motorbike on a track running parallel to the road some 300 m away. From there we drove to Robat-e-Poshtebadam where we met with a driver from Nayabandan and changed vehicles. At 11h15 we entered Nayabandan Wildlife Refuge and drove for 114 km until we arrived at Flourin Mine at 13h30. It was quite hot, windy and dusty. The habitat varied from extreme arid areas with no vegetation to some quite green areas with scattered low scrub. Most of the area comprised wide open plains with some rocky broken areas. We drove fast but only encountered four groups of camels comprising 41,21,45, and 43 = 150 animals. We visited one spring but did not find any tracks of animals. In the late afternoon we took a 10 km drive around the area visiting two water holes. At the first we found tracks of a fox and at the second there were old mud tracks of hyaena, jackal and fox, also sheep. We saw one ibex.

Friday 17 May: We conducted a survey in the North West of Nayabandan, leaving at 06:40 and turning at Galobisheh Spring, where a scat that may have been from a cheetah was found. We returned along the same route. One gazelle was flushed by the motorbike on the return journey.

Saturday May 18: We surveyed an area to the east of the mine, only leaving at 08h30 because of the possibility of meeting up with Mr Baham Najafi, the head of Nayabandan. In the event we only met him later at Kalzard Camp at 15h00. We then surveyed a different area back to Flourin Mine. We saw four Jabeer gazelle and a fawn. I have been struck by the few animals of any description we have seen, not only mammals but also reptiles and birds.

Mr Najafi told me that five cheetah deaths have been recorded over the last seven years in Nayabandan. One was reported to have drowned in floods, another to have fallen to its death over a precipice in an attempt to avoid a car travelling along a road, one was run over by a car, one was hunted down on a motorbike and killed and one was found buried. The three perpetrators of the motorcycle incident were he reported sentenced to 14 years in prison. He does not think that other cheetahs have been killed by people in recent years as cheetahs are not blamed for stock losses whereas leopards and especially wolves are. He believes that gazelle were killed in large numbers during and after the revolution. His assessment for the 1.4 million ha wildlife refuge is 15 cheetah, 10 leopard and 300 hyaenas, (in my opinion this is far too high – see main report). This perhaps illustrates the perception held that hyaena are detrimental to cheetahs. He seemed to think that there are more gazelles in the wildlife refuge than would appear and offered the opinion that they go into the hills during the day to escape from hunters and emerge onto the plains to feed at night.

Sunday May 19: Mr Rahgoshai had to go back to Tehran and Mr Baham Najafi and I together with Mr Ali Nazarain, a local English teacher from Tabas as interpreter travelled from Flourin to Gosimi Salty Spring in the centre of the wildlife refuge. We then went on to Cheka Mountain Spring and then back to Gosimi, spending the night at the camel herder's camp close by. We saw virtually no animals, but some of the desert scenery was absolutely stunning. We were also fortunate to see two Pleske's ground jays (Iran's only endemic bird) and at the earthen dam at the camel herders camp I was amazed to see, a flock of about 120 Red-necked phalaropes and about 10 Wilson's phalarope as well as 20

or so whiskered terns. By the next morning all the phalaropes, except for about 10 of the red-necked phalaropes had gone.

Monday May 20: In the morning we surveyed an area known as Ghasami Plains in the vicinity of the camel herder's camp and saw two Houbara bustard's and one Jabeer gazelle, and then continued south east to Ali Abud Station, arriving at the station at 21h10. Again we passed through some spectacular desert landscapes and also visited another earthen dam belonging to the other camel herder in central Nayabandan where I again saw whiskered terns as well as three black winged stilts.

Tuesday May 21: In the morning we were taken to an area close to Ali Abud where cheetah tracks had recently been found along a wadi. We were able to follow these tracks along the wadi and found two tamarisk trees around which several cheetah scats were scattered. This wadi drained into another larger one called "Aspi? Wadi" where fresh cheetah and hyaena tracks were found. We returned to Ali Abud at about 12:00 pm to wait for the arrival of Mr Ali Joubachian. He and Mr Mohammad Farhadinia, Director of the Iranian Cheetah Society arrived in the early afternoon. We spent most of the afternoon discussing the cheetah program in general and my role in particular. Mr Joubachian emphasised again that he did not regard the survey as a priority and was far more interested in my assessment of the relationship between cheetahs and hyaenas in Nayabandan and on what I regarded as the important issues in cheetah conversation. We discussed this issue at length and again I emphasised that I thought that it was very important to establish a survey technique for potential cheetah prey as it was critical to be able to measure in some way changes in prey abundance over time. In the late afternoon we went for a short drive towards Nayabandan Village.

Wednesday May 22 and Thursday May 23: We set off from Ali Abud at 07:20 on 22 May travelling west at first then moving south, stopping at regular intervals to look for tracks. Much of the area was dryer than the areas we had previously travelled through. We spent the night near a "kavansarai" then continued south and east the next day, stopping at mid-day at Rabat.Chehel.Payeh Kavansarai where we found evidence for three gazelle having been slaughtered. Judging by the blood and hair at one sight the animal had been recently slaughtered; i.e. within the last few months. We came to the asphalt road on the eastern border of Nayabandan Wildlife Refuge in the early afternoon and returned to Ali Abud via Nayabandan Village.

Friday May 24: We spent the morning surveying the hilly areas close to Ali Abud and revisiting some of the areas we had previously visited on 21 May, further discussing the behaviour of cheetahs and hyaenas and aspects of the research and management of cheetahs in Iran. We also examined the collection of sheep and ibex remains, collected by the game guards and ascribed to cheetah predation. I did not feel well and spent the rest of the day sleeping!

Saturday May 25: Feeling fine again, we packed up and drove to Tabas, visited the DOE office there and in the afternoon flew back to Tehran. In the evening I met with the three young and enthusiastic founders of the Iranian Cheetah Society.

Sunday May 26: I visited the UNDP office and met with Mehdi Kamyab for a short debriefing meeting and the completion of various administrative matters. I was then taken to the DOE office and met with Dr Eric Sanderson from WCS. We discussed many of the issues and aspects of the cheetah program. In the afternoon we had a final meeting with Ali Joubachian.

Monday May 27: I departed from Theran at 1130. On my way to the airport I had a brief meeting with Dr Timothy O'Brien from WCS who has been doing similar surveys in other cheetah areas. At a stop over in Dubai I met with Sean Mckeown and Cynthia Olson from CCF.

Appendix II. Birds identified in Nayabandan Wildlife Refuge during the survey.

Striated heron
Kestrel
Barbary falcon
Chukar
See-see partridge
Houbara bustard
Black-winged stilt
Little ringed plover
Dunlin
Redshank
Common sandpiper
Wilson's phalarope
Red-necked phalarope
Whiskered tern
Crowned sandgrouse
Rock dove
Laughing dove
Common cuckoo
Common swift
Desert lark
Crested lark
African rock martin
Barn swallow
Yellow wagtail
White wagtail
Hooded wheatear
Hume's wheatear
Paddyfield warbler
Icterine warbler
Spotted flycatcher
Golden oriole
Isabelline shrike
Lesser grey shrike
Chough
Pleske's ground jay
Raven
Trumpeter finch