



Mission report of a field trip to Iran

23 August - 4 September 2010



Dr Stéphane Ostrowski

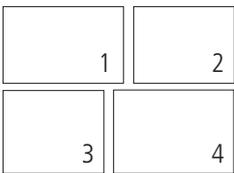
WCS

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Wildlife Conservation Society

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Cover photos:

1. Participants to a workshop on wildlife chemical immobilization, Parvar Protected Area, Semnan Province, 25 August 2010.
2. From left to right: Dr. Babak Jourabchian (CACP), Dr. Stephane Ostrowski (WCS), Mr. Mohammad Farahdunia (CACP), and Mr. Ali Khani (DoE), discussing the technical aspects of a capture operation of goitered gazelles, Shirahmad Wildlife Refuge, Khorasan Razavi Province, 27 August 2010.
3. Dr. Stephane Ostrowski lecturing on principals of wildlife chemical immobilization, Parvar Protected Area, Semnan Province, 25 August 2010.
4. "Kushki" is the only known Asiatic cheetah currently in captivity, Miandasht Wildlife Refuge, north Khorasan Province, 29 August 2010.

All photographs: Conservation of the Asiatic Cheetah Project (CACP) and Stephane Ostrowski.

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Introduction

The mission I have carried out in Iran between August 23rd and September 4th, 2010¹ had four main aims, with emphasis on the first one:

1. Meet the leadership staff of the Department of Environment (DoE) of the Islamic Republic of Iran² (I.R.I.) in order to officialize WCS commitment in the second phase of the Conservation of Asiatic Cheetah Project (CACP) and assess the level of progress of CACP on conservation activities as itemized in the Species Action Plan designed in April 2010 in Gstaad, Switzerland, under the guidance of the Cat Specialist Group of IUCN.
2. Achieve progress in the conservation activities the Wildlife Conservation Society (WCS) has agreed to contribute to: feasibility and technical design of a prey base reinforcement operation in Touran National Park and Miandasht Wildlife Refuge³, landscape-scale mapping of cheetah habitat and gap analysis to detect potential habitats of importance outside protected areas, increasing health expertise connected to the CACP.
3. Deliver four half-day workshops on topics selected by CACP.
4. Visit at least three protected areas within the network of 10 priority areas for the Asiatic cheetah in order to learn about progress on the ground of conservation activities, and provide any technical expertise upon request.

¹ The summary of daily activities is presented in Appendix 1.

² Name, affiliation and occasionally email address of people met during the mission are compiled in Appendix 2.

³ Details concerning protected areas visited and wildlife sighted during the mission are compiled in Appendix 3.

Meeting leadership staff of DoE and learning about CACP progresses

The mission in Iran was the occasion to officialize the cooperation between the DoE/CACP and WCS. I met Dr. Sadough, the Deputy Head of Natural Environment and Biodiversity Division at DoE as well as Mr. Mohamadi, the Director of Wildlife Office at DoE Tehran. Both officials welcomed me with enthusiasm and encouraged a fruitful collaboration between DoE and WCS. Unfortunately I could not meet Mr. Mohammadizadeh, Vice-president of the Islamic Republic of Iran and also Head of the Department of Environment. I should receive soon a letter from Mr Mohamadi acknowledging the collaboration between DoE and WCS for the second phase of the Asiatic cheetah project.

The mission also offered the opportunity to learn more about the work progresses of CACP. I was very pleased to observe that the Action Plan meeting organized in April 2010 in Switzerland has had a very positive guidance impact on CACP operations. CACP has developed considerable efforts in educational activities (workshops, meeting with local stakeholders, publication of a variety of educative material such as Asiatic Cheetah Habitat Book series [2,000 copies for each cheetah protected areas] and posters), in game guard training and mentoring (organization of professional workshops, publication and distribution of standardized field notebooks, three game-guard mentors employed by CACP and present in protected areas, a consistent and regular information feed-back system put in place), in professional communication (publication and dissemination of newsletters, employment of a media coordinator within CACP team, organization of regular press conferences), in community-conservation (continuing awareness initiatives with local communities with the help of collaborating NGOs), science and monitoring (implement a first large-scale camera-trapping effort in Kavir NP, attempt a transect count for herbivores in Miandasht Wildlife Refuge).

During the current mission, the staff of CACP openly communicated about their results and provided me copies of educational materials⁴, newsletters and results of camera trapping in Kavir NP. I could also witness while in the field the progress in information feed-back between CACP and game guards (Plate 1).

WCS input in CACP

Prey-base reinforcement

One of the main technical requests addressed to me by CACP during my mission in Iran was to assess the relevance and feasibility of a goitered gazelle (*Gazella subgutturosa*)

⁴ Examples of such material are provided in Appendices 4 & 5.

reinforcement operation in Miandasht Wildlife Refuge and Touran National Park, with the foreseen benefit of an increased prey-base for carnivores and particularly for cheetahs.



Plate 1. CACP staff (left) meeting in the field with game guards (right) in Touran National Park, Semnan Province, 26 August 2010.

I have visited preferred goitered gazelle habitats in both protected areas and have observed that goitered gazelles still occur in these reserves. However, it was not possible to assess objectively their relative abundance given the shortness of surveys. Yet I noted, almost systematically, the presence of at least one young for each observed mature female, suggesting that reproduction occurs actively in both areas and survival of young animals is relatively high (assuming that the majority of young animals observed were born in spring 2010). Alireza Jourabchian mentioned that goitered gazelles used to be far more abundant in these areas “in the past”, such as “at least 4,000 individuals in Miandasht” alone. Nowadays the goitered gazelle populations have been estimated at 300-400 and 600 individuals, in Miandasht and Touran, respectively. Main threats affecting gazelle populations in both reserves include overhunting and forage depletion due to overgrazing by livestock. Recently however it seems that overgrazing was to some extent put under better control in Miandasht by controlling more efficiently grazing rights and seasonal

pasture rotations (Mr Farhadinia, pers. comm.). In Touran, due to the size of the area (>14,000 km²), the easiness of access and the low number of game guards relative to the size of the area to supervise (a total of 25 game guards divided in two groups of 12-13, rotating every 18 days), sustainability of livestock grazing is likely difficult to control. Rampant illegal hunting still occurs in both areas. Since this threat has been identified as the main cause of gazelle population decline, the DoE will have to implement a significantly higher level of protection in both areas should a gazelle reinforcement operation be considered in the future. As a matter of fact, all attempts, worldwide, at reinforcing existing populations of wildlife without controlling simultaneously the cause of decline of the target population, have failed to achieve long-term population reinforcement. We have also visited the gazelle population of Shirahmad Wildlife Refuge proposed for harvesting. Results of our brief survey (see later) suggest that because of its relative proximity, large population size and management possibilities (see later) this population would accept a reasonable level of harvesting for translocation to other protected areas. To conclude, I have recommended to CACP/DOE that a pilot project aimed first at translocating a cohort of 50 goitered gazelles from Shirahmad to Miandasht could be considered in the near future. I will produce a technical document that will help DoE implement such project.

Databasing and GIS work

CACP expects to base its scientific activities on a centralized database of all confirmed cheetah sightings documented for at least the last 15 years. Such database should also receive some analytical considerations to identify possible trends and highlight coarse demographic features. Apparently CACP has compiled such database but still needs to check the quality of entries. I have asked CACP (Mr. Farhadinia) to provide me with the structure of the database in order for me to check whether an additional level of information could be added to it and evaluate its usefulness for the envisioned GIS gap analysis.

I have visited the staff of the GIS laboratory at central DoE in Tehran to learn about their knowledge in GIS modeling. It seems that the level of expertise of this team is high but mainly focused at mapping efforts. I have discussed with the staff the benefit of a gap analysis for the Asiatic cheetah that would provide predictive clues about important areas to supervise or explore outside protected areas. They did not seem to have any experience in gap analysis modeling but were very eager to learn. I proposed, whenever the database will be completed and thoroughly checked, to invite a GIS specialist from WCS to guide

them through the gap analysis process. The ultimate goal of this work would be to produce a landscape-scale habitat model for Asiatic cheetahs.

The work progress has been planned in three main steps:

1. Finalize and review the current cheetah database and probably adjust it to a GIS usage (evaluate databasing effort). Mr. Farhadinia at CACP will send me the database for review as soon as possible.
2. Guide the GIS staff at DoE through a gap analysis modeling, with the help of a GIS experts from WCS (capacity building).
3. Produce priority habitat maps for cheetahs in Iran (mapping) and diffuse modeling results to CACP/DoE and project's partners.

Health component in Asiatic cheetah conservation

The risk posed by diseases on the survival of big cats has recently received more consideration in view of the documented impact of morbilliviruses (e.g. canine distemper virus) on wild carnivore populations. For the second phase of CACP activities, it was collegially decided to include health as an important component to the Asiatic cheetah conservation plan. The first workshop I have provided in Tehran during the current visit aimed at illustrating to DoE the importance of health considerations in wildlife conservation projects. I have also extensively communicated with veterinarian, Babak Jourabchian, who is working on health issues with CACP for the forthcoming 12-14 months. Dr. Jourabchian (son) will translate a number of documents and lectures I have provided to him and use this material to start a series of training sessions for game guards in the 10 priority protected areas identified for cheetahs. In addition to this activity, I have proposed to organize during my next mission a one week intensive training course for two veterinarians and two biologists that would include theoretical lectures and practical trainings. The main goal of such training course would be to constitute a task force that will have sufficient knowledge to perform wildlife chemical immobilization, particularly in emergency situations, health examinations and urgent necropsy investigations. Eventually I will be working with the help of Dr. Jourabchian and a number of other Iranian veterinarians on a guideline document of wildlife diseases occurring in Iran that should hopefully be translated into Farsi when completed.

Science and monitoring

CACP is very willing to develop science and monitoring activities with the help of foreign expertise. I have extensively discussed with CACP staff about population estimation techniques, particularly for herbivores. Capture-recapture models applied to camera-trapped identifiable individuals may also prove promising to increase our knowledge of cheetah abundance in Iran. Such operations need thorough thinking, careful preparations and relatively large numbers of camera traps. I have also warned that in view of likely small population sizes, high level of dispersal, semi-nomadic behavior of the species and harsh conditions in its habitat this technique may eventually provide robust but imprecise estimates of population sizes or in worst cases only a minimum number of individuals (see Kavir NP).

Concerning cheetah captures for telemetry study, WCS would only play a role of collaborator to Panthera, the likely main partner of CACP for such activities. I repeatedly insisted on the fact that big cat capture is a very technical commitment, which can prove harmful to the animal if not practiced by a thoroughly trained and qualified staff. Currently no such level of expertise seems to exist in Iran, at least to my knowledge. WCS is willing to invest time and resources at training such staff should serious candidates be proposed for the work.

Education and workshops

I have delivered four half-day workshops using electronic presentations⁵. Topics presented during these workshops were selected after discussion and agreement with CACP. The first workshop took place at DoE headquarter in Tehran and was attended by almost 50 people originating from the DoE, NGOs and academic spheres. I introduced the concepts of ecosystem health and ecology of wildlife diseases, illustrating the relative importance of infectious diseases, the vulnerability of susceptible animals and the increasing importance of health in the conservation of threatened species. The second workshop took place at the DoE headquarter of Parvar Protected Area, Semnan Province, and was attended by c. 35 people from provincial DoEs of Semnan/Fars/Mazandaran/Tehran provinces, NGOs, and students. I lectured on theoretical and practical aspects of chemical immobilization applied to Iranian wildlife. I distributed at this occasion a three page document (translated in Farsi by Babak Jourabchian) including a table of main drug combinations to anesthetize most terrestrial mammals occurring in Iran⁶. The third workshop took place at the DoE headquarter of North Khorasan Province in the city of Bojnurd. It was attendant by c. 15

⁵ Dates of these workshops are documented in Appendix 1

⁶ This document is provided as Appendix 6

people mainly from the provincial DoE. I presented an example of restoration of a severely degraded landscape in a hyper arid habitat, emphasizing at the ecosystem prowess at self-restoring, even in extreme conditions, provided management of threats is consistently and sustainably performed. The fourth, and final workshop was delivered at the central DoE headquarter in Tehran and was attendant by c. 45 people from the DoE, NGOs, and students. I presented and explained the principles and technical feasibility of gazelle translocations for reintroduction/reinforcement goals. All electronic presentations were provided to CACP and freely distributed in power point format to attendants willing to have a copy of it. According to CACP, all workshops were very successful and considered useful by the majority of participants (AliReza Jourabchian, pers comm.). The fourth workshop was followed by a press conference (see paragraph entitled “Other achievements”).

Visits to protected areas⁷

During the current mission I have had the chance to visit eight protected areas and with the exception of one of them (Salouk National Park) to meet the head staff responsible of these areas, discussing with them a variety of technical topics. Touran, Miandasht and Kavir were of particular interest to me as these areas are part of the network of 10 priority protected areas for the Asiatic cheetah. In these areas I witnessed the efforts made by CACP staff at communicating with game guards on cheetah conservation activities, debriefing with the leadership staff about recent signs of presence of cheetahs (including in other protected areas), discussing logistical problems, mentoring and financial programs. It was my impression that a genuine effort was developed at communicating to game guards on the importance of their work and in return at forwarding to the head office in Tehran their requests about logistical problems they were facing at protecting efficiently cheetahs, their prey and habitats.

Touran National Park and Miandasht Wildlife Refuge

In Touran and Miandasht I mainly focused at observing goitered gazelles, examining fenced enclosures in place and visiting a captive cheetah.

While the population size of goitered gazelles in Touran is, in my opinion, inadequately estimated, a useful effort was recently piloted by CACP at estimating gazelle population size in Miandasht using transect estimation methods. In this area transect estimation suggested a total population size of 300-400 animals (confidence interval of the transect

⁷ List and details concerning visited protected areas are available in Appendix 3

estimation was not provided to me but was apparently large). I recommended CACP to put in place simple index methods (kilometric, spot-sighting...) that will help document gazelle population trends in Touran and Miandasht. Considering the low detectability of cryptic desert herbivores, the large escape distances (sometimes reaching kilometers), typical low densities and difficult terrains, experience shows that “indices” methods, informing about trends and to some extent population composition, are among the most realistic demographic estimators for desert herbivores. These methods can be readily explained to game guards and combined with their routine surveillance efforts. Although failing to provide indications of total abundance, these indicators have the benefit of being easy to put in place, easy to analyze and less expensive to operate. A yearly or bi-annual total or transect count would also provide indications of minimum population sizes. Both indicators combined would allow a better monitoring of cheetah prey-base populations than currently done. A similar approach could be developed for jebeer gazelles (*Gazella bennetti*) in Kavir National Park.

Both in Touran and Miandasht, pre-release enclosures have been built for a variety of intentions. While in Miandasht the enclosure has not been completed, there is a ‘ready for use’ 700 ha enclosure in Touran located about 6 km from the main game guard camp (Delbar). This enclosure was erected recently as a pre-release facility for onagers (*Equus hemionus onager*). Currently it hosts no onager but would definitely be of some use should a goitered gazelle reinforcement operation is considered for the area. It is to be noted that numerous adjustments would need to be added to the structure should it be considered in the future for such purpose. Last, because of its location and orientation (cutting the course of several dry river beds) there is a high probability that the fence will suffer significant damages when heavy rainfalls will happen (as observed in Shirahmad).

The only known Asiatic cheetah currently in captivity has been named ‘Kushki’, and is kept in a 12 ha Artemisia-vegetated enclosure in Miandasht Wildlife Refuge, at very close distance (<300 m) from a game guard station (Plate 2).

The visit to ‘Kushki’ was of particular meaning to me as I was directly involved in its translocation from Mazinan village in Semnan Province, where it was retrieved from a poacher by Mr Reza Kushki, to the Pardisan Eco-Park in Tehran on January 15, 2008. At that time I estimated his age at 6-7 months from its denture examined under chemical tranquillization. When visiting him on August 29, 2010, I therefore witnessed a 37-38 month-old fully-grown male Asiatic cheetah in excellent body condition.

Upon closer examination I even noticed significant thoraco-abdominal subcutaneous fat deposition indicative of some level of over-feeding (Plate 3).

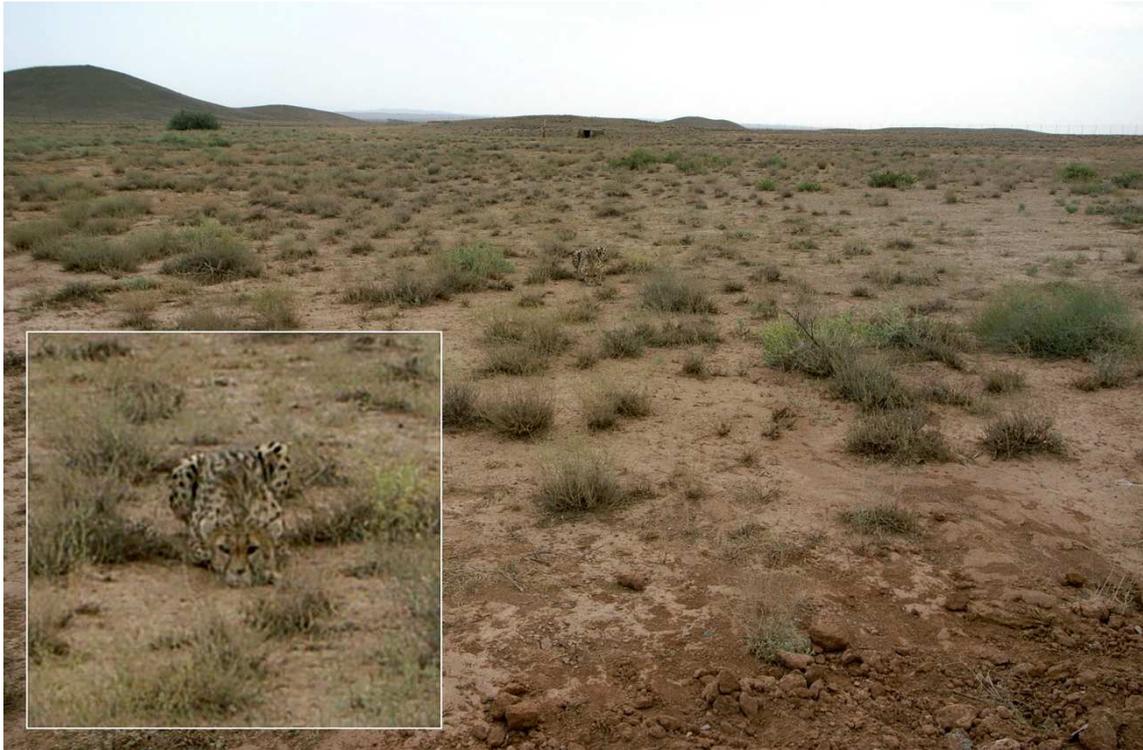


Plate 2. Where is the cat? Even in very flat and open landscapes, cheetahs are remarkably efficient at hiding. The stalk is an important hunting technique governing the outcome of a cheetah hunt. Here captive 'Kushki' in a 12-ha Artemisia-vegetated enclosure in Miandasht Wildlife Refuge, North Khorasan Province, 29 August 2010.

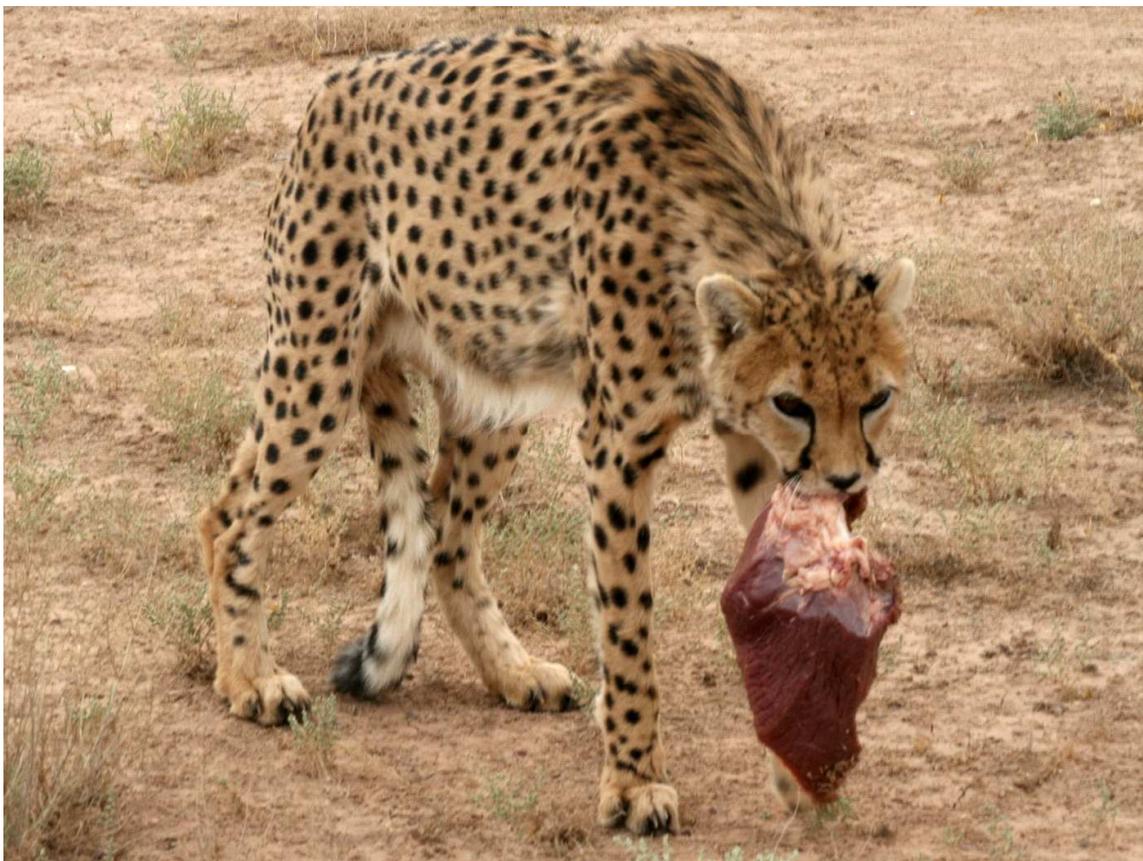


Plate 3. 'Kushki' the 37-38 month-old captive male Asiatic cheetah with its daily ration of 2kg beef meat in the mouth, Miandasht Wildlife Refuge, North Khorasan Province, 29 August 2010.

Obviously despite the relatively large size of its enclosure 'Kushki' is little active and is fed every 3-4 days with a live rabbit or Cape hare (*Lepus capensis*) and the other days with 2 kg beef meat daily (Plate 3).

I therefore instructed CACP and the game guard in charge of food provision to the cheetah to revise his diet. From literature and physiological calculations, an adult captive cheetah requires c. 150 kJ/kg body mass (BM) of metabolizable energy every day. Based on an estimated BM of 40 kg, 'Kushki' would therefore require about 6,000 kJ/day of metabolizable energy. Assuming raw beef meat of human consumption quality provides about 4,700 kJ metabolizable energy/kg (80-90% digestibility in cheetah), 'Kushki' should receive at best 1.3-1.5 kg of beef meat per day. Currently he receives 2 kg/day of beef meat or 25-30% in excess of the quantity he requires. I recommended CACP staff to reduce Kushki's diet to 1.5 kg beef meat daily which will be enough to cover its maintenance and limited activity requirements. This estimate is very comfortable as it has been shown that metabolic rate in wild cheetahs is lower than that, even so free-ranging animals are obviously more active than captive ones. Providing a 1.5-2 kg rabbit/hare every 3-4 days must be continued as it brings the necessary nutrients and vitamins A/D₃ (in liver) and Ca/P (in bones). If available 'Kushki' could also be provided meat of donkey and horse as this is relatively cheap. However meat of equids contains relatively little lipids and mainly polyunsaturated fats, so the diet must also include ruminant meat that will bring more fat and vitamin Bs, especially during cold winter. I also instructed the staff not to provide meat of fowl (chicken) because of a variety of sanitary concerns such as susceptibility of cats to avian influenza viruses. A large size sheep/goat bone should be provided occasionally. Staff in charge should be aware that an increasing number of captive wild felids die of gut impaction because of consumption of foreign bodies, and uncontrolled extra feeding may have deleterious effect on Kushki's nutrition. Staff should therefore strictly implement a non-feeding policy for visitors (remove regularly foreign stuff from the enclosure and fix information panels on the enclosure fence). Clean water should be offered ad libitum. Reducing daily food income of 'Kushki' by 25-30% would keep him leaner and eventually fitter if breeding is considered in the future. It will also save almost 25\$/week, 1,300\$/year, or the equivalent of 3-4 month salary for an additional game guard.

In Miandasht Wildlife Refuge I was also lucky to be shown the fresh footprints of an adult female cheetah with two cubs (Plate 4). Remarkably Mr. AliReza Jourabchian mentioned that cheetah breeding was confirmed this year in 5 of the 10 priority protected areas for the species. Sadly a female with two cubs was recently road-killed near Touran. On August 23, I was offered the chance to make a gross external examination of this skinned and eviscerated female kept frozen at the taxidermy workshop of central DoE in Tehran.

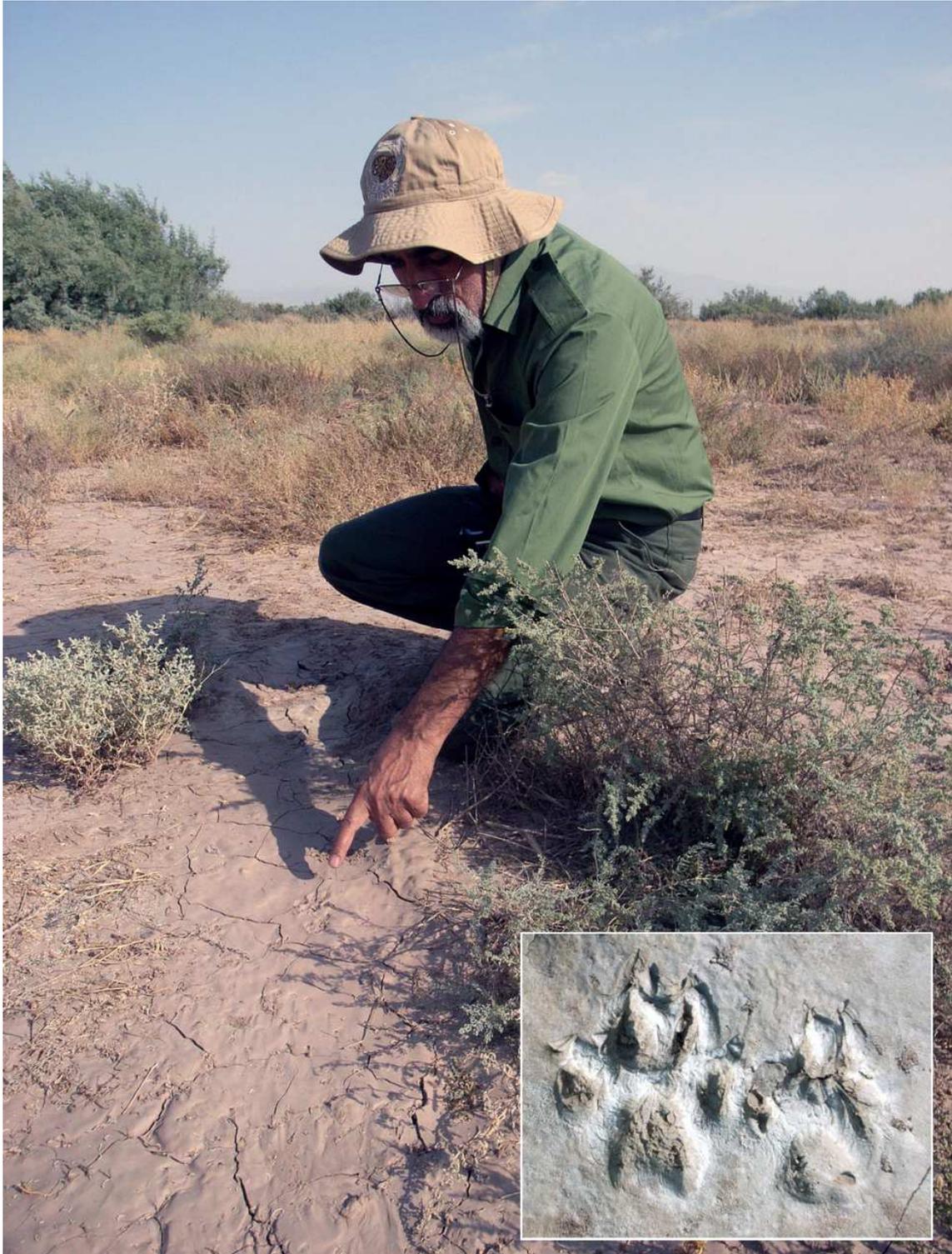


Plate 4. Mr. Alireza Jourabchian showing a well marked footprint of an Asiatic cheetah cub, as highlighted in the insert. Miandasht Wildlife Refuge, North Khorasan Province, 29 August 2010.

It was a lean young adult with no subcutaneous fat deposits and a fractured right femur. These body condition observations are in accordance with what has been recorded in female African cheetahs appearing to operate at an energetic deficit when lactating/raising

cubs. According to game guards interviewed in Touran the female and her cubs were killed while attempting to reach an area with wild sheep (*Ovis orientalis*), a prey of larger size than gazelles. This switch to large preys may be required to accommodate the anabolic growth requirements of emerged cubs but has also been hypothesized as a strategy to reduce energetic expenditures on travels.

Shirahmad Wildlife Refuge

The goitered gazelle in Shirahmad Wildlife Refuge offers a different situation compared to Touran and Miandasht. Shirahmad hosts a large population (est. >2,500 specimens) of free-ranging gazelles over the relatively small surface (228 km²) of an open and flat landscape with little vegetation cover that could restrict detection of gazelles. In addition because animals are supplemented with food and water on a daily base [a management activity routinely practiced in protected areas in Iran aimed at keeping wild herbivores in core zones (Plate 5)] their fear of game guard cars is reduced. I have recommended implementing a bi-annual transect monitoring of the gazelle population using Distance sampling method. Expected higher encountering rate due to easier detection and high density should allow to retrieve population estimates of higher precision (CV<15%)⁸. The current population size suggests that reasonable harvesting for population reinforcement goals in Miandasht and Touran (see above) would be acceptable.

Shirahmad also hosts a small population [11 (1:10) counted specimens] of jebeer gazelles kept captive in an enclosure within the Refuge's boundary. The conservation finality of this population remains questionable. About 3 years ago two adult males and three adult females were released from the enclosure (Mr. Khani pers. comm.). The two males 'vanished' from the vicinity of the enclosure shortly after being released. Two of the three females were recaptured 1-1.5 year later and moved back to their enclosure of origin. We observed the third female, still present in the vicinity of the enclosure, and for the first time since being released with a 4-6 month-old young. The origin of this young is evidently of great concern since no free-ranging male jebeer is said to occur in Shirahmad. There is a low probability that the young has been fathered by one of the released males that would still be present in the area, yet overlooked among male goitered gazelles, but the highest probability is that the youngster is a hybrid *subgutturosa* x *bennetti* a cross-breeding that has already been documented in captivity.

⁸ CV = [100 x standard error/mean], is the coefficient of variation of the estimate. The lower CV and the more precise is the estimate.



Plate 5. Water supplementation is a wildlife management activity widely practiced in protected areas in Iran. It aims at sedentarize wild herbivores and their predators in best-protected core zones of wildlife reserves. Miandasht Wildlife Refuge, North Khorasan Province, 29 August 2010.



Plate 6. Jebeer gazelles (*Gazella bennetti*) kept captive in Shirahmad Wildlife Refuge. From left to right: one adult male and five adult females. Note in the male a swelling (likely an abscess) on the left mandibular bone, Shirahmad Wildlife Refuge, Khorasan Razavi Province, 28 August 2010.

I believe that it is extremely urgent to remove this likely hybrid specimen from the free-living population of goitered gazelles to avoid further dissemination of *bennetti* species genes within the goitered gazelle population. Every attempt should also be made to recapture the dam and reinsert it into the captive herd. In the meantime we also recommend to translocate the captive population of jebeer gazelles to an area where they could be used as captive breeders for population reinforcement with no risks of hybridization with *G. subgutturosa*. Within the cheetah protected area network this could for example apply to the Kavir National Park.

In Shirahmad one immediately notices a several km long, chain-link-mesh, 3-m-high fence running along the south-western edge of the protected area. It was erected recently in an attempt to prevent gazelles from visiting villagers and their farms located in the south-west of the protected area. While the concern of reserve's managers at fulfilling their wildlife protection mandate is laudable the efficiency of such structure to protect the goitered gazelles is to be questioned. As a matter of fact heavy and condensed-in-time rainfalls (>25 mm in one time) that occurred a couple of months before our visit have mildly damaged the fence at numerous locations and more significantly at passage sites of three main wadis (natural river beds dry for most of the year). During that unpredictable precipitation event more than 350 gazelles composed mainly of less than one year old animals have apparently died (Mr Khani, pers. comm.). Currently the fence no longer plays its role of movement limitation for gazelles and I have observed in the early morning gazelles coming back to the protected area from the south-west, through the collapsed fence. In addition to being of limited protection value, should it be restored, the fence may pose a significant ecological threat to gazelles during drought periods. Indeed goitered gazelles in fenced reserves in the Middle East have been observed to aggregate along fences during drought in a vain attempt to cross it in order to reach better forages. This "aggregation" behavior has often translated into mass mortalities due to starvation. Restraining within fences desert species adapted to a nomadic way of life that has evolved in response to scarce and unpredictable food resources is often deemed to fail.

So what kind of management could better apply to Shirahmad's goitered gazelle population? One must first realize that any wildlife management effort that has succeeded to achieve a density of 10-13 goitered gazelles/km² could be considered from a certain perspective as a success. Evidences however suggest that Shirahmad goitered gazelle population may suffer of some level of overpopulation. One reason to such situation is that the area is relatively small (ie controllable) and isolated within a local human society displaying variable levels of bellicosity against gazelles (Mr. Khani pers. comm.). Another very important reason is that the population is year-round supplemented with food and water, a management practice that contributes to sedentarize the population and to

enhance its productivity (Plate 7). When seen from such perspective one may easily foresee that continuing food and water supplementation and constraining natural nomadic life via fencing may dangerously increase the population density (and overgrazing as a corollary) to such a point that a dramatic demographic collapse may happen in case of forage shortage. Several creative approaches may help resolve the management concerns. One approach would be to continue a similar, somehow successful, management policy but append a “destocking” component to it, in other words remove surplus gazelles from Shirahmad to maintain the population below the ecological capacity of the reserve. The surplus could reinforce populations suffering demographic decreases in other protected areas. Another management, not exclusive from the previous one, would be for DoE to approach the communities of local hunters and allow them a certain level of legal hunting in return of a respect of quotas, hunting season, gender/age classes limitations and a contribution to the protection of the animals. Likewise such an initiative could be developed as part of a pilot project that would test locally the communities’ willingness to be involved in wildlife protection. All these ideas could be further discussed and refined, but in my opinion Shirahmad offers a rare opportunity to test a number of wildlife management options relatively new for the country.



Plate 7. Flat open landscape in Shirahmad Wildlife Refuge showing in the foreground dry alfalfa (*Medicago sativa*) distributed to goitered gazelles (*Gazella subgutturosa*) as a food supplementation, 28 August 2010.

Kavir National Park

The visit to Kavir National Park was very instructive and gave us an overview of the difficulty to develop efficient predator monitoring projects in arid environments. CACP has recently developed a wealth of activities in this protected area that has apparently been unfairly “forgotten” during the first phase of CACP operation. Aside of educational and managerial inputs an attempt was made to estimate the cheetah population size using capture-recapture models adapted to camera-trapping method. Between November 2009 and March 2010, 36 and 28 camera traps were deployed for four and three months, respectively, in the two main mountain ranges of the protected area. Only one individual cheetah (>30 pictures) was captured by camera traps, as well as one Persian leopard (*Panthera pardus*) and an unknown number of wolves (*Canis lupus*), jackals (*Canis aureus*), striped hyenas (*Hyena hyena*), red foxes (*Vulpes vulpes*), caracals (*Caracal caracal*) and wild herbivores. The same cheetah individual was located in both mountain ranges (separated by about 60 km). Although methodological details of the operation are not fully known to me, the number of camera-traps relative to the size of the surveyed area (<450 km²) and the duration of deployment suggest that the effort to detect the maximum number of cheetah specimens potentially occurring in the area were valid. Results strongly support low cheetah numbers in Kavir NP. To the best of knowledge, we can conclude that at least one individual occurred in Kavir at that time, and that capture-recapture population size modeling could not be used because of the small sample size. The reasons of the apparent low cheetah population size in an area with assumed good prey base, not exposed to overgrazing from livestock and benefitting significant poaching control are unknown and would certainly be worth addressing in a larger and longer scientific research effort.

Parvar Protected Area and Salouk National Park

Our visits to Parvar Protected Area and Salouk National Park were very short, and we hardly had any time to see wildlife. Both reserves are in mountainous areas on the southern slope of the Alborz mountain range. In the lower, southern, outreaches of Salouk National Park we observed a small number of goitered gazelles. This population has apparently recently suffered dramatic decline due to poaching. From an estimated total of 1,000-1,200 animals eight years ago the population is said to currently number as few as 70-300 individuals (Jourabchian from game guard pers. comm.). It is interesting to remark that cheetahs have apparently never been recorded in the area despite the recent occurrence of large numbers of goitered gazelles and the proximity of Miandasht (c. 40 km) where they still occur and breed. The inability of cheetahs to prey gazelles in very

open terrains, such as in Salouk lowlands was proposed by Mr. Farhadinia as a hypothesis to explain this situation.

Golestan National Park and Dasht-e Naz Wildlife Refuge

I have also had the chance to perform a short visit to the iconic Golestan National Park where I could witness over less than 50 km length a stunning mosaic of ecotypes responding to a conspicuous west to east decrease in precipitations.

The trip to Dasht-e Naz, Mazandaran Province, allowed me to visit the ‘birth place’ of the Persian fallow deer (*Dama dama mesopotamica*) propagation program in Iran. Dating back to before the Revolution, two male and three female Persian fallow deers were captured in the wild in Dez and Karkheh in Khuzestan Province. One female died during the official release in Dast-e Naz fenced Wildlife Refuge, explaining that the current captive population originates from only four founders. Yet, breeding of fallow deers in Dasht-e Naz proved successful despite likely high inbreeding level, and surplus specimens were successfully translocated to enclosures in Urumiyeh National Park (West and East Azerbaijan Provinces), Semeskandeh Wildlife Refuge (Mazandaran Province) and Arjan-Parishan Protected Area (Fars Province)⁹. The visit to the area gave me the opportunity to see one of the very last fragments of lowland primary oak forest in Mazandaran Province and discuss translocation and chemical immobilization procedures for deers with the local staff.

Baba Aman recreational area

Shortly before our visit to the DoE headquarters of North Khorasan, I visited the recreational area of Baba Aman, in the vicinity of the city of Bojnurd. The fenced area hosts a number of captive terrestrial herbivores and injured (old wing fractures) birds of prey for display to visitors. Non-exhaustive list of captive species include wild sheep (*Ovis orientalis*), wild goats (*Capra aegagrus*), goitered gazelles, red deer (*Cervus elaphus*), golden eagle (*Aquila chrysaetos*), Bonelli’s eagle (*Hieraaetus fasciatus*), long-legged buzzard (*Buteo rufinus*) and steppe buzzard (*Buteo buteo vulpinus*). I discussed with the husbandry and veterinary staff in charge of this DoE-managed facility about diet improvement, environmental enrichment, quarantine procedures, and importance of necropsies and investigative approaches.

⁹ Details concerning the history of the Persian fallow deer captive-breeding in Dasht-e Naz were provided by Mr. Alireza Jourabchian.



Plate 8. AliReza Jourabchian (CACP), Stephane Ostrowski (WCS) and Mohammad Farhadinia (CACP) responding to questions of news media on a variety of topics centered at Asiatic cheetah conservation, DoE Headquarter, Tehran, 31 August 2010.

Other achievements and commitments

Meeting Iranian NGOs

My visit to Iran was also the occasion to learn more about the involvement of national NGOs in wildlife conservation projects. While in Tehran I met the staff of the Iranian Cheetah Society (www.wildlife.ir) and Plan for the Land Society (www.plan4land.org), two NGOs intimately involved in community conservation and scientific monitoring (camera-trapping) works developed by CACP. The talented and enthusiastic staff involved in these important components of CACP activities was eager to share views and experiences concerning the project they were involved in and retrieve from me as much technical guidance as possible. Such type of informal interaction is in my opinion very important to motivate in order to broaden the local composition of partnership and motivate the transfer of scientific knowledge to younger generations. I have also met members of the Persian Wildlife Foundation (www.persianwildlife.org), an NGO not involved directly in the conservation of the Asiatic cheetah but willing to develop under DoE agreement scientific monitoring activities on other species of concern, and also very interested in activities that could favor a sustainable use of natural resources.

Press conference

At 2:00 pm on Tuesday 31st August, after the fourth workshop, CACP organized a one-hour long press conference at the DoE headquarters in Tehran. Alireza Jourabchian, Mohammad Farhadinia and I were questioned by news media (print, broadcast, and internet-based) on a variety of topics centered on the conservation of the Asiatic cheetah (Plate 8). As far as I was concerned I emphasized that cheetah conservation in Iran is a very long term commitment and that current activities developed by DoE/CACP were appropriate to help save this subspecies from extinction. Medias were also interested to know my opinion on three other topics.

1. Asiatic cheetah in Iran. I answered that captive-breeding is one tool in the toolbox of conservationists, yet in my opinion it should be considered only as an “ultimate commitment” and developed only in case of clear indications that the species is facing an immediate risk of extinction or opportunistically in case of captive individuals which cannot be released in the wild. Cases of wildlife captive-breeding combined to successful reintroduction are very rare and certainly extremely time-consuming and expensive. Currently, although the situation is precarious, evidences of immediate risk of extinction of the Asiatic cheetah are not conspicuous and I would, by far, privilege investing the limited resources devoted to wildlife conservation in preserving and protecting the population of cheetah still free-living in Iran than in efforts at propagating the species in captivity, particularly in view of the difficulty at reintroducing large carnivores in the wild.
2. The second topic concerned the recent acquisition by I.R.I of a couple of tigers from Russia to start a reintroduction project. I answered that both tigers belonged to the Siberian subspecies, recently documented as the closest living relative to the extinct Caspian tiger subspecies. Since both animals were born in captivity there was no welfare objections at having them captive in another country provided hosting facilities were adequate. As of these animals being released into the wild, I.R.I had enough good scientists and technical experts to evaluate whether such ambitious project could be achieved successfully.
3. The third question concerned the willingness expressed by Indian conservationists to receive Asiatic cheetah founders in order to start a captive-breeding project in India. I answered that, in my opinion, in view of the possible low number of effective contributors to the population gene pool, attempts to capture and translocate several couples of free-ranging cheetahs from Iran to India could jeopardize population survival and precipitate the decline of the only known free-

ranging population of this subspecies in the world. In addition captive-breeding of large cats has been widely developed in the world but examples of successful reintroduction of these top predators are very rare. Finally should such collaboration develop, an agreement that would first benefit the Iranian population would certainly be the most valid from the perspective of global conservation. Expensive and high-tech technology used at propagating Asiatic cheetahs in captivity in India could also be transferred to Iran.

Debriefing with UNDP

On Saturday 12 June 2010 the UN Resident Coordinator and UNDP Resident Representative in the Islamic Republic of Iran (I.R.I), Ms. Consuelo Vidal and Vice President and Head of the Iranian Department of Environment, Mr. Mohammad-Javad Mohammadzadeh jointly signed the project document for the Conservation of the Asiatic Cheetah and Its Habitats, which marked the last day of the Environment Week in Iran. With a fund of US\$ 4 million, the second phase of the Asiatic Cheetah Conservation Project and Its Habitats (ACCPH) sets research and scientific monitoring, enhanced protection and awareness raising and education among local communities as its priority objectives. United Nations Development Programme (UNDP) Iran and International organizations contribute US\$ 500,000 and the Government of the Islamic Republic of Iran allocate a sum of US\$ 3.5 million to the second phase of the Project, the activities of which have been anticipated to be carried out in the next two years time. As part of the collaboration WCS is developing with CACP/DoE, I debriefed on Wednesday 1 September 2010 the main achievements of the current mission with the Deputy Resident Representative of UNDP in I.R.I, Ms Elzira Sagynbaeva and UNDP Programme Specialist, Mr Mehdi Kamyab. I also discussed a number of conservation ideas that could be developed in the future mainly aimed at involving more actively local communities in protected area management and promote sustainable use of natural resources.

Further developments

Further collaborative involvements of WCS in the Asiatic cheetah conservation project will consist of:

1. Gazelle reinforcement pilot project in Miandasht Wildlife Refuge: Produce a detailed methodological document that will help DoE implement safely and efficiently this operation. Contribute, if proposed by the DoE, to the implementation phase of this project.

2. Databasing and GIS work: Review the cheetah database compiled by CACP (via Mr Farhadinia), input adjustments and invite a WCS GIS expert to guide DoE GIS staff through a gap analysis modeling for the Asiatic cheetah in Iran.
3. Wildlife health: Provide guidance to Dr. Babak Jourabchian (CACP) at delivering wildlife health basic training courses to game guards, organize and implement an intensive training course for two veterinarians and two biologists at CACP in order to build the capacity of a health task force within DoE, produce a guideline document for wildlife diseases in Iran.
4. Cheetah telemetry: Collaborate with CACP and Panthera in cheetah telemetry.
5. Cheetah prey-base monitoring: Collaborate with CACP in the development of transect monitoring of gazelles in Shirahmad Wildlife Refuge, and index monitoring of wild ungulates in cheetah priority protected areas.
6. Propose a TOR document to UNDP to support a preliminary research on the current status of trophy-hunting activities in the I.R.I.

Acknowledgments

I thank Dr Sadough, Deputy Head, Natural Environment and Biodiversity Division of DoE and his staff both in Tehran and in provinces for welcoming me in Iran with such great hospitality.

The mission could not have been carried out successfully without the support of all CACP staff members. I thank them all for their active involvement in the organization of the mission. Mr. Alireza Jourabchian was an invaluable source of information and an experienced mission leader. Mr. Mohammad Farhadinia was also an excellent informant and a very assiduous and careful interpreter. Eventually I enjoyed very much the professional interactions I have had with Mr. Babak Jourabchian.

Appendix 1. Summary of daily activities during the mission in the I.R. of Iran

Day No.	Day	Persian Date	Date	برنامه	Program	محل اقامت/ Residence
1	Monday	دوشنبه 1 شهریور	23 Aug	ملاقات با آقای دکتر صدوق و مدیران کل حوزه معاونت، نشست با کارکنان بخش GIS	Meeting Dr Sadough and other directors, meeting GIS experts in DoE	هتل تاج محل Taj Mahal Hotel, Tehran
2	Tuesday	سه شنبه 2 شهریور	24 Aug	کارگاه تخصصی بیماری های حیات وحش و بازدید از کارگاه تاکسیدرمی سازمان	Workshop 1: Introduction to wildlife diseases at DoE Tehran and visit of the taxidermy workshop in DoE to examine dead specimens of cheetah	هتل تاج محل Taj Mahal Hotel, Tehran
3	Wednesday	چهارشنبه 3 شهریور	25 Aug	کارگاه تخصصی دامپزشکان در محل هتل سنگسر مهدی شهر	Workshop 2: Introduction to wildlife immobilization in Semnan Province	پرور Parvar Protected Area
4	Thursday	پنج شنبه 4 شهریور	26 Aug	بازدید از پارک ملی توران	Visiting Touran NP	پاسگاه دلیر Shirahmad Wildlife Refuge
5	Friday	جمعه 5 شهریور	27 Aug	بازدید از پناهگاه حیات وحش شیر احمد	Visiting Shirahmad WR	شیر احمد Miandasht Wildlife Refuge
6	Saturday	شنبه 6 شهریور	28 Aug	بازدید از پناهگاه حیات وحش میاندشت	Visiting Miandasht WR	سالوک Salouk National Park
7	Sunday	یکشنبه 7 شهریور	29 Aug	بازدید از پارک بابا امان بجنورد برای بررسی وحوش آنجا و همچنین برگزاری نشست با مدیریت و کارکنان اداره کل خراسان شمالی	Visiting Baba Aman Park, Bojnurd, workshop 3: Desertic landscape restoration, visiting Golestan NP	گلستان Golestan National Park
8	Monday	دوشنبه 8 شهریور	30 Aug	بازدید از پارک ملی گلستان، قرق و دشت ناز ساری و بازگشت به تهران	Visiting Ghorogh, Dasht-e Naz WR and back to Tehran	هتل تاج محل Taj Mahal Hotel, Tehran
9	Tuesday	سه شنبه 9 شهریور	31 Aug	کارگاه آموزشی بیهوشی و انتقال حیات وحش در سازمان، کارگاه آموزشی در دانشکده دامپزشکی تهران	Workshop 4: Gazelle translocation and reintroduction at DoE in Tehran, press conference, meeting with NGOs	هتل تاج محل Taj Mahal Hotel, Tehran
10	Wednesday	چهارشنبه 10 شهریور	1 Sep	استراحت و بازدید از باغ وحش تهران	Meeting veterinarians and debriefing with UNDP, then travelled to Kavir NP	قصر بهرام Qasre-Bahram Caravanserail, Kavir NP
11	Thursday	پنج شنبه 11 شهریور	2 Sep	بازدید از پارک ملی کویر	Visiting Kavir NP, returning to Tehran	هتل تاج محل Taj Mahal Hotel, Tehran
12	Friday	جمعه 12 شهریور	3 Sep	بازگشت به تهران و کنفرانس خبری	Visiting veterinarians, discussion with Mr Kamyab and Mr Jourabchian about further developments	Leaving the country
13	Saturday	شنبه 13 شهریور	4 Sep	ترک ایران	Departure	

Appendix 2. List of main people met during the mission in the I.R. of Iran

No.	Affiliation	Name	Title/ Position	Province	Email contact
1	DOE	Mr. Sadough	Deputy Head, natural Environment and Biodiversity Division	Tehran	Dr_sadough@yahoo.com
2	DOE	Mr. Mohamadi	Director of Wildlife Office	Tehran	
3	DOE	Mr. Ebrahimi	Director DOE Fars Province	Fars	
4	DOE	Mr. Zurhabi	Director DOE Semnan Province	Semnan	
5	DOE	Mr. Mamashti	Director DOE North Khorasan Province	North Khorasan	
6	DOE	Mr. Absalan	Deputy Director North Khorasan Province	North Khorasan	
7	DOE	Mr. Ghorbanloo	Director of Touran National Park	Semnan	
8	DOE	Mr. Ghandalidoust	Director of Kavir National Park	Semnan	
9	DOE	Mr. Rostaghi	Director of Golestan National Park	Golestan	
10	DOE	Mr. Khani	Director of Shirahmad Wildlife Refuge	Khorasan Razavi	
11	DOE	Mr. Harati	Director of Miandasht Wildlife Refuge	North Khorasan	
12	DOE	Mr. Gordmardi	Expert in transboundary protected areas	North Khorasan	e.gordmardi@yahoo.com
13	DOE	Mr. Alis	Expert for DOE	Fars	mohamadalis11@gmail.com
14	DOE	Mr. Bali	GIS expert at Central DOE	Tehran	bali51@yahoo.com
15	DOE	Mr. Bahmanpour	GIS expert at Central DOE	Tehran	bahmanpour_arash@yahoo.com
16	DOE	Mr. Zabihi	GIS expert at Central DOE	Tehran	zabihi56@gmail.com
17	DOE/CACP	Mr. Jourabchian	CACP Manager	Tehran	ali_jourabchian@yahoo.com
18	DOE/CACP	Mr. Farhadinia	CACP Deputy manager	Tehran	msfarhadinia@yahoo.com
19	DOE/CACP	Mr. Jourabchian (Babak)	CACP veterinarian	Tehran	dvm_babak2002@yahoo.com
20	UNDP	Mrs. Sagynbaeva	Deputy Resident Representative in Iran	Tehran	elzira.sagynbaeva@undp.org
21	UNDP	Mr. Kamyab	Program Specialist	Tehran	mehidi.kamyab@undp.org
22	UNDP	Mr. Ferdowsi	Program analyst	Tehran	saeid.ferdowsi@undp.org
23	NGO	Mr. Eslami	Manager Director, Iranian Cheetah Society	Tehran	m.eslami@wildlife.ir
24	NGO	Mr Moqanaki	Wildlife Biologist, Iranian Cheetah Society	Tehran	ehsan.moqanaki@gmail.com
25	NGO	Mr. Khaleghi	Wildlife Conservationist, PLAN4the LAND	Tehran	a.h.khaleghi@gmail.com
26	NGO	Mr. Tahbaz	Persian Wildlife Foundation	Tehran	morad@mtcapital.net
27	Non-affiliated	Mr Memarian	Veterinarian	Tehran	animal_protector19@yahoo.com
28	Non-affiliated	Mr Kachiri	Veterinarian	Tehran	kamrankachiri@yahoo.com
29	Non-affiliated	Mr Ekrami	Veterinarian	Dasht-e Naz	Ekrami1614@yahoo.com

Appendix 3. Protected areas visited and wildlife sighted during the mission to the I.R. of Iran

No.	Date	Name	Administrative status / size / Province	Recent occurrence of cheetah	Main wildlife species observed (number)
1	25 Aug	Parvar	Protected Area / 666 km ² / Semnan	No	Wild sheep (captive), golden eagle, partridges
2	26 Aug	Touran	National Park + Wildlife Refuge + Protected Area /14,415 km ² / Semnan	Yes	Onager (c. 35 with 13 juveniles), goitered gazelle (5+)
3	27 Aug	Shirahmad	Wildlife Refuge / 228 km ² / Khorasan Razavi	No	Goitered gazelle (>250), jebeer gazelle (11 captive + one free-ranging), hybrid goitered x jebeer (?) (1), black-bellied sandgrouse (5+), Cape hare (1)
4	28 Aug	Miandasht	Wildlife Refuge / 844 km ² / North Khorasan	Yes	Goitered gazelles (24, incl. 10 juveniles), jackal (2), cheetah (1 captive + tracks of 1 adult female with 2 cubs), red fox (1 dead), golden eagle (1), partridges
5	28 Aug	Salouk	National Park / 82 km ² /North Khorasan	No	Goitered gazelles (12)
6	29 Aug	Golestan	National Park / 871 km ² / Golestan	No	Goitered gazelle (10-20), wild sheep (120-160), wild boar (2), golden eagle (1), griffon vulture (3), partridges
7	30 Aug	Dasht-e Naz	Wildlife Refuge / 0.56 km ² (fenced) / Mazandaran	No	Persian fallow deer (8 out of 26 present)
8	2 Sept	Kavir	National Park + Protected Area /6,911 km ² / Semnan	Yes	Jebeer gazelle (12), wild sheep (15+), wild goat (25+)

Appendix 4. Asiatic Cheetah Habitats series

The Asiatic Cheetah Habitats series is a publication produced by CACP that intends to inform people living around the ten 'priority protected areas' for cheetahs about the biology and conservation of the species. Herein the front page of volume 2 dedicated to Bafgh Protected Area (104 pp), 2,000 copies produced.

Asiatic Cheetah Habitats
Volume 2
Protected Area **Bafq**

یوزپلنگ آسیایی یکی از نادرترین گربه‌سانان جهان بوده که در بالاترین طبقه حفاظتی فهرست سرخ IUCN یعنی در طبقه "در آستانه انقراض" جای گرفته است. این در حالی است که در زمان‌هایی نه چندان دور جمعیت‌های بزرگی از یوزپلنگ در غرب آسیا از صحرای سینا تا شبه قاره هندوستان پراکنده بوده است. شواهد نشان می‌دهد تا اواخر قرن نوزدهم در حدود یکصد هزار قلاده یوزپلنگ در ۴۴ کشور آسیایی و آفریقایی می‌زیسته‌اند. اما از اوایل قرن بیستم نسل یوزپلنگ‌ها رو به کاهش گذاشت. اکنون نزدیک دو دهه است که تنها جمعیت کوچکی از یوزپلنگ آسیایی در مناطق تپه‌ماهوری و کوهستانی فلات مرکزی ایران باقی مانده است. به عبارت دیگر اکنون ایران آخرین پناهگاه یوزپلنگ در آسیا بوده و ما حافظ آخرین بازمانده‌های این جانور باشکوه هستیم.

از سال ۱۳۸۰ تاکنون، پروژه حفاظت از یوزپلنگ آسیایی فعالیت‌های زیادی را در زیستگاه‌های یوز در کشور انجام داده است که این فعالیت‌ها در بخش‌های حفاظتی، علمی و آموزشی بوده است. در این میان فعالیت‌های آموزشی جایگاه ویژه‌ای در پروژه دارد.

کتاب منطقه حفاظت‌شده کوه بافق یکی از آخرین دستاوردهای پروژه در بخش آموزشی است که جهت آگاهی‌رسانی و ترویج فرهنگ محیط‌زیستی در راستای حفاظت از یوزپلنگ آسیایی در کشور به‌ویژه در داخل و اطراف زیستگاه‌های منتخب گردآوری شده است.



شابک: ۹۷۸-۶۰۰-۵۴۲۵-۰۵-۰۵
شابک دوره: ۹۷۸-۶۰۰-۵۴۲۵-۰۷-۹


پروژه حفاظت از یوزپلنگ آسیایی
وزارت محیط زیست
UNDP

Conservation of Asiatic Cheetah Project (CACP)

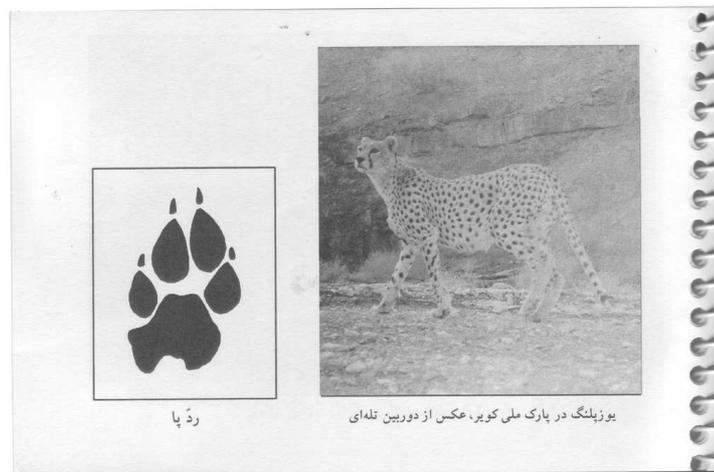
Appendix 5. Game Guards Field Notebook

Game Guards Field Notebook is a standardized publication distributed to game guards in the 10 “priority protected areas” for cheetahs. The main goal of the document is to offer a standardized and informative support to improve raw information collection by game guards (a- standard sighting record page, b-footprint reminder, c-introduction pages).

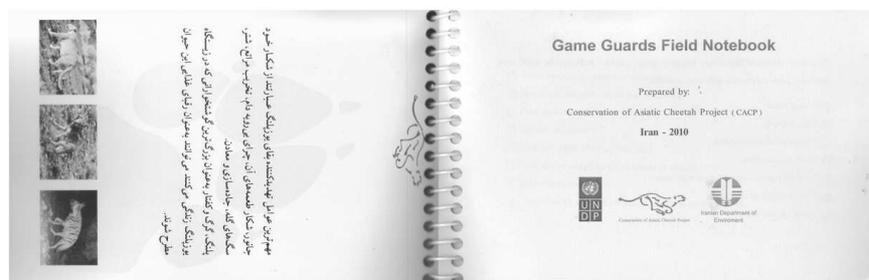
۱۲. جزئیات گوستخواران مشاهده شده

ردیف	نام گونه	تعداد نر	تعداد ماده	تعداد نر/ماده	محل مشاهده	زمان مشاهده (تاریخ - ساعت)	موقعیت جغرافیایی (GPS)	توضیحات
۱	یوزپلنگ							
۲	پلنگ							

a



b



c

Appendix 6: Chemical restraint of terrestrial mammals from Iran. A document for veterinarians and wildlife biologists

Dr Stéphane Ostrowski

Wildlife Conservation Society

August 2010

The present document lists the most common wild mammal species encountered in Iran and the drug combinations used for their clinical examination or for minor surgical procedures.

Species — Species are sorted by order, family and scientific name. When available, common names in Persian are provided (*A Field Guide to the Mammals of Iran*, Ziaie, 1996, ‘anglicized’ by Mr Houman Jowkar).

Body mass — Average body masses are provided for adult specimens. They are derived from the literature (especially from the *Handbook of Wildlife Chemical immobilization*, Kreeger, 1999 and the *New Encyclopedia of Mammals*, McDonald, 2001) and from measurements I have made in Western Asia since 1996.

Drugs — Provided drugs are suitable under most circumstances to achieve tranquilization and safe handling of wild animals. Two drugs are usually combined for the chemical restraint of animals. They should be administered in the same syringe intramuscularly (IM)¹⁰. Dosages of drug combinations provided in Tables 1 and 2 are either derived from the *Handbook of Wildlife Chemical Immobilization* (Kreeger, 1999) or are extrapolated from dosages reported in the literature for close species and adjusted when necessary according to my personal field experience. Although I believe they would be the best choice for artiodactyls, I did not include opiate derivatives (etorphine, fentanyl, carfentanil, butorphanol) in the tables as these drugs and their antagonists (diprenorphine, naloxone, naltrexone) are difficult to obtain and are dangerous to use. Whenever possible I have tried to provide combinations including ketamine and xylazine because these drugs readily available in Iran (although only as a 2% solution for xylazine). Table 1 summarizes proposed drug combinations for chemical restraint of the most common species of wild mammals in Iran, while Table 2 focuses on intramuscular dosages of ketamine-xylazine combination for rodents weighing less than 1 kg. Table 2 provides average values, and several species may require much higher dosages. More work is needed to adjust dosages of this drug combination to the large variety of rodent species occurring in Iran.

¹⁰ Tiletamine + zolazepam combination (Telazol, Zoletil) is sold as ready-to-use preparations.

Antagonists — If the recommended drugs can be antagonized, the appropriate antagonistic drug is mentioned and dosage is provided. Antagonists are given IM unless otherwise stated.

Further reading — I recommend reading the *Handbook of Wildlife Chemical Immobilization* (Kreeger, 1999) for further information concerning remote delivery procedures, precautions of use, drug side effects, and emergency procedures.

Table 1. Proposed drug combinations for chemical restraint of the most common species of wild mammals in Iran

Order	Family	Scientific name	Common name	Name in Persian	Average adult body mass	Drugs (combinations and dosages)	Antagonists
Insectivora (insectivores)	Erinacidae (hedgehogs)	<i>Hemiechinus auritus</i>	Long-eared hedgehog	Kharposht e-gush boland	0.2–0.5 kg	5 mg/kg ketamine + 0.2 mg/kg medetomidine	0.1 mg/kg atipamezole
		<i>Erinaceus europaeus</i>	European hedgehog	Kharposht e-Urupai	0.5 – 1 kg	5 mg/kg ketamine + 0.2 mg/kg medetomidine	0.1 mg/kg atipamezole
		<i>Paraechinus hypomelas</i>	Brandt's hedgehog	Kharposht e-Irani	0.5–1 kg	5 mg/kg ketamine + 0.2 mg/kg medetomidine	0.1 mg/kg atipamezole
Chiroptera (bats)					<0.1 kg	10 mg/kg ketamine + 2 mg/kg xylazine	Not reported
Carnivora (carnivores)	Felidae (cats)	<i>Caracal caracal</i>	Caracal	Karakal	7–12 kg	6.5 mg/kg Telazol/Zoletil*	Not reported
		<i>Felis silvestris</i>	Wild cat	Gurbeh ye vahshi	2–7 kg	10 mg/kg ketamine + 0.05 mg/kg medetomidine or 5 mg/kg Telazol/Zoletil*	0.3 mg/kg atipamezole Not reported for Telazol/Zoletil*
		<i>Felis manul</i>	Pallas's cat	Gurbeh ye pallas	2–5 kg	8 mg/kg ketamine + 0.05 mg/kg medetomidine	0.3 mg/kg atipamezole
		<i>Felis margarita</i>	Sand cat	Gurbeh ye sheni	1.5–3 kg	10 mg/kg ketamine + 0.05 mg/kg medetomidine or 5 mg/kg Telazol/Zoletil*	0.3 mg/kg atipamezole Not reported for Telazol/Zoletil*
		<i>Felis chaus</i>	Jungle cat	Gurbeh ye jungali	4-6 kg	6.5 mg/kg Telazol/Zoletil*	Not reported
		<i>Panthera pardus</i>	Leopard	Palang	35–80 kg	3 mg/kg ketamine + 0.07 mg/kg medetomidine or 6 mg/kg Telazol/Zoletil* or 3 mg/kg Telazol/Zoletil + 35µg/kg medetomidine	0.35 mg/kg atipamezole Not reported for Telazol/Zoletil*
		<i>Acinonyx jubatus</i>	Cheetah	Yuz palang or Yuz	25–40 kg	2-3 mg/kg Telazol/Zoletil + 40µg/kg medetomidine or 4 mg/kg Telazol/Zoletil*	0.4 mg/kg atipamezole 0.03 mg/kg flumazenil or 0.1 mg/kg sarmazenil reported for Telazol/Zoletil*

	Canidae (dogs)	<i>Canis lupus</i>	Wolf	Gorg	15–45 kg	10 mg/kg ketamine + 2 mg/kg xylazine	0.15 mg/kg yohimbine or 0.2 mg/kg atipamezole
		<i>Canis aureus</i>	Jackal	Shoghal	7–15 kg	10 mg/kg Telazol/Zoletil*	Not reported
Carnivora (carnivores)	Canidae (dogs)	<i>Vulpes cana</i>	Blanford's fox	Shah rubah	1–1.5 kg	12 mg/kg ketamine + 0.05 mg/kg medetomidine or 10 mg/kg Telazol/Zoletil*	0.3 mg/kg atipamezole Not reported for Telazol/Zoletil*
		<i>Vulpes rueppellii</i>	Sand fox	Rubah e-Sheini	1.2–2.6 kg	12 mg/kg ketamine + 0.05 mg/kg medetomidine or 10 mg/kg Telazol/Zoletil*	0.3 mg/kg atipamezole Not reported for Telazol/Zoletil*
		<i>Vulpes vulpes</i>	Red fox	Rubae e-mamouli	3–6.5 kg	12 mg/kg ketamine + 0.05 mg/kg medetomidine or 10 mg/kg Telazol/Zoletil*	0.3 mg/kg atipamezole Not reported for Telazol/Zoletil*
	Hyaenidae (hyenas)	<i>Hyena hyena</i>	Striped hyena	Kaftaar	25–45 kg	5 mg/kg Telazol/Zoletil or 10 mg/kg ketamine + 1 mg/kg xylazine	Not reported for Telazol/Zoletil* 0.11 mg/kg yohimbine or 0.2 mg/kg atipamezole
	Herpestidae (mongooses)	<i>Herpestes auropunctatus</i>	Small Indian mongoose	Khadang	1.1–2.4 kg	4 mg/kg ketamine + 6.5 mg/kg xylazine	0.5 mg/kg atipamezole
	Mustelidae (mustelids)	<i>Lutra lutra</i>	Common otter	Sheng	3–14 kg	50 mg/kg ketamine + 3 mg/kg xylazine	0.125 mg/kg yohimbine
		<i>Martes foina</i>	Stone marten	Samur e-sangi	0.5–2 kg	4 mg/kg Telazol/Zoletil I* + 3 mg/kg xylazine	Not reported
		<i>Mellivora capensis</i>	Ratel	Rudak e-asalkhar	3–6 kg	8 mg/kg ketamine + 0.5 mg/kg xylazine or 2.2 mg/kg Telazol/Zoletil*	0.3 mg/kg atipamezole Not reported for Telazol/Zoletil*
		<i>Mustela nivalis</i>	Weasel	Raasu	0.05–0.35 kg	5 mg/kg ketamine + 0.1 mg/kg medetomidine	0.5 mg/kg atipamezole
	Ursidae (bears)	<i>Ursus arctos</i>	Brown bear	Khers e-qahvehi	100–325 kg	8 mg/kg Telazol/Zoletil* or 2 mg/kg Telazol/Zoletil* + 0.06 mg/kg medetomidine or 11 mg/kg ketamine + 11 mg/kg xylazine	Not reported for Telazol/Zoletil* 0.3 mg/kg atipamezole 0.125 mg/kg yohimbine
<i>Ursus thibetanus</i>		Asiatic black bear	Khers e-siyah	65–90 kg (f) 110–150 kg (m)	4.4 mg/kg Telazol/Zoletil*	Not reported	

Artiodactyla (artiodactyls)	Bovidae (bovids)	<i>Capra aegagrus</i>	Wild goat	Kal o-boz or Pazan	25–45 kg (f) 70–90 kg (m)	1.7–2.3 mg/kg xylazine + 3.1–4.3 mg/kg ketamine	10–15 mg/animal atipamezole (2/3 IV + 1/3 IM)
		<i>Gazella bennetti</i>	Jebeer gazelle	Jebeer	15–25 kg	7 mg/kg ketamine + 8.5 mg/kg xylazine	0.05 mg/kg methoxy–odazoxan (RX821002A) or 0.15 mg/kg yohimbine
		<i>Gazella subgutturosa</i>	Goitered gazelle	Ahu	15–25 kg	7 mg/kg ketamine + 8.5 mg/kg xylazine	0.05 mg/kg methoxy–odazoxan (RX821002A) or 0.15 mg/kg yohimbine
		<i>Ovis orientalis</i>	Urial sheep	Ghooch o-Mish	36–87 kg (m)	1.7–2.3 mg/kg xylazine + 3.1–4.3 mg/kg ketamine	10–15 mg/animal atipamezole (2/3 IV + 1/3 IM)
	Cervidae (deers)	<i>Cervus elaphus</i>	Bactrian deer	Maral	60–180 kg	2.2 mg/kg ketamine + 0.11 mg/kg medetomidine	0.5 mg/kg atipamezole (½ IV + ½ IM)
		<i>Dama dama</i>	Fallow deer		40–110 kg	4 mg/kg ketamine + 3 mg/kg xylazine	0.125 mg/kg yohimbine
	Suidae (pigs)	<i>Sus scrofa</i>	Wild boar	Goraz	50–200 kg	3 mg/kg Telazol/Zoletil* + 1.6 mg/kg xylazine	10–15 mg/animal atipamezole Not reported for Telazol/Zoletil*
Perissodactyla (perissodactyls)	Equidae	<i>Equus hemionus onager</i>	Onager	Gur or Gurkhar	150–250 kg	Combinations including opiate derivatives are required	
	Hystriidae (porcupines)	<i>Hystrix indica</i>	Crested porcupine	Tashi	10–25 kg	7.5 mg/kg Telazol/Zoletil*	Not reported

*Brand denominations of Telazol™ and Zoletil™ are for US and Europe, respectively. It is an association of tiletamine and zolazepam chlorhydrates at equal mg/mg ratio. Thus 5 mg of Telazol/Zoletil represents 2.5 mg of tiletamine plus 2.5 mg of zolazepam.

Table 2. Intramuscular dosages of ketamine-xylazine combination for rodents weighing less than 1000 g. For animals weighing less than 250 g, a 10 to 20-fold dilution in sterile water of the ketamine-xylazine combination is required for a precise administration of the drugs.

Body mass (gram)	Dose xylazine (mg)	Dose ketamine (mg)	Sleep time (minute)
20	0.2–0.4	1–2	<1
50	0.4–0.8	2–3	<1
100	0.6–1	3–5	1.5–2
250	1–2	5–8	3–5
500	2–5	10–15	5–7
1000	3.3–6.5	16.5–25	10–15

