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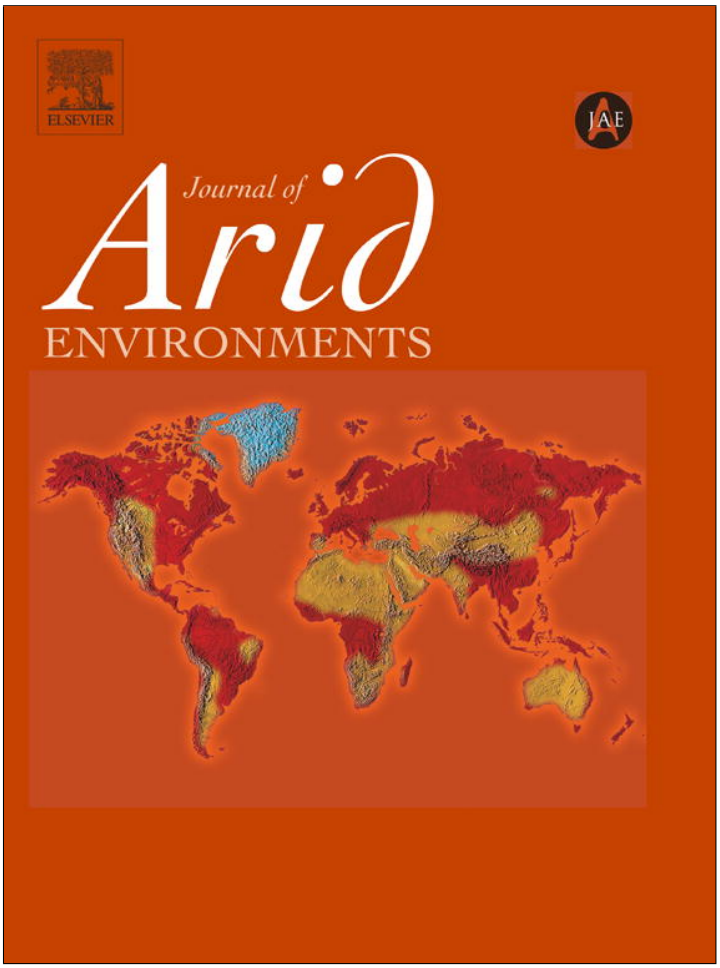

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Feeding ecology of the Asiatic cheetah *Acinonyx jubatus venaticus* in low prey habitats in northeastern Iran: Implications for effective conservation

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ABSTRACT

Feeding ecology of the critically endangered Asiatic cheetah was investigated from 2004 to 2009 in northeastern Iran where prey population has been depleted due to poaching. The survey was mainly based on scat analysis, complemented by kill monitoring and local inquiries of direct observations. Results of the research revealed that the Asiatic cheetahs mainly rely on medium-sized ungulates. However, with respect to low density of gazelles, they catch a considerable proportion of their food demands based on livestock which brings the cheetahs in direct conflict with local people. Meanwhile, smaller mammals only meet a small proportion of cheetah's diet. Our data indicate high importance of enhancing conservation efforts in northeastern Iran as well as other cheetah habitats where normal prey ungulates have experienced severe decline.

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1. Introduction

Historically, the cheetah (*Acinonyx jubatus*) occurred widely throughout much of non-forested Africa, the Middle East and southern Asia (Caro, 1994). The critically endangered subspecies Asiatic cheetah (*Acinonyx jubatus venaticus*) (IUCN, 2010), has experienced the most severe decline among the cheetah confirmed subspecies, both in its area of occupancy and in its numbers over the recent century (Nowell and Jackson, 1996). The Asiatic cheetah was formerly distributed from the Indian subcontinent through Afghanistan, Turkmenistan and Iran to the Arabian Peninsula and Syria (Ellerman and Morison-Scott, 1966). However, over the past three decades, Iran has been the last stronghold for a few dozens of Asiatic cheetahs (Farhadinia, 2004), occurring within several verified areas across the eastern half of the country, including the North Khorasan Province in northeastern Iran, near Turkmenistan.

Food habits are an important aspect of the ecological niche of carnivores which has been intensively studied on African cheetahs (e.g. Caro, 1994; Marker et al., 2003; Mills et al., 2004; Schaller, 1972; Wachter et al., 2006). The cheetah is an opportunistic predator whose prey varies in size from small birds and rodents to adult ungulates as large as zebra (*Equus quagga*) and wildebeest (*Connochaetes taurinus*) in Africa (Caro, 1994; Marker et al., 2003; Schaller, 1968). However, the morphological adaptations of the cheetah appear to have evolved to optimize capture of medium-sized prey that can be subdued with minimal risk of self injury (Hayward et al., 2006). The frequency of predation on each species depends primarily on availability of prey, as well as the suitability of the habitat structure in which the cheetah must hunt (Mills et al., 2004).

Cheetahs are also known to kill small livestock (Marker-Kraus et al., 1996) and claims of cheetahs killing young camel, sheep, and goat are rife among the shepherds within the species range (e.g. Dragesco-Joffe, 1993; Marker et al., 2003; Saleh et al., 2001; Selebatso et al., 2008); however, it is not known for the Iranian cheetahs.

Little is known about the feeding ecology of the Asiatic cheetahs, and so it remains one of the most challenging questions for wildlife

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experts and managers in Iran. Based on surveys conducted in some cheetah habitats in the country (e.g. Naybandan and Dare Anjir), the species preys primarily on mountainous ungulates such as wild sheep (*Ovis orientalis*) and Persian ibex (*Capra aegagrus*) (Farhadinia, 2004; Hunter et al., 2007). The only habitats where cheetah presence has been confirmed in northeastern Iran, as well as neighboring Turkmenistan, overlaps with that of Persian gazelle (*Gazella subgutturosa*) habitat (Heptner and Sludski, 1992). Food habits of carnivores can be assessed by various methods (see Mills, 1984, 1992), however, each method is subject to biases (Klare et al., 2011). Direct observations of kills can often be difficult in certain habitats and using scat analysis (Godbois et al., 2005), based on indentifying undigested prey remains in scat, may be preferred for species that are not easily observed. This method has previously been applied for the cheetah (Marker et al., 2003; Wachter et al., 2006) as well as many other felids, such as leopard (*Panthera pardus*) (Henschel et al., 2005; Johnson et al., 1993), cougar (*Felis concolor*) (Ackerman et al., 1984), and Pallas's cats (*Otocolobus manul*) (Ross et al., 2010).

This paper describes the food habits of the Asiatic cheetah and identifies the relative importance of the different prey species in the diet of cheetahs in northeastern Iranian habitats. These areas (i.e., Miandasht Wildlife Refuge and Behkadeh No Hunting Area) have depleted population size of natural prey (i.e., bovids) compared to other cheetah habitats in Iran. Results of this research are important for developing species and ecosystem management strategies (Mills, 1992) and can provide conservation managers a realistic perspective of cheetah habitats where medium-sized prey has been drastically depleted. In addition, it is hoped that this research will motivate managers to be more aware of the scope and intensity of potential cheetah-livestock conflict which can affect significantly the species survival in Iran.

2. Study area

This study was conducted within the Miandasht Wildlife Refuge (WR) and the Behkadeh No Hunting Area (NHA), the only two areas where cheetahs are confirmed to exist in northeastern Iran.

2.1. Miandasht Wildlife Refuge

The Miandasht WR, located near the city of Jajarm, was designated as wildlife refuge in 1973 by the Iranian Department of the Environment (DoE). This 84,435 ha area has a large network of dry river beds and depressions, intermingled with clusters of hills and plateaus. The Miandasht WR altitude is between 900 and 1340 m, with a mean annual temperature of 14 °C and an arid climate with an average rainfall of 150 mm (Darvishsefat, 2006). The WR is surrounded by a number of human settlements, mostly in south and northeast – in the winter, an estimated 15,000 head of livestock are permitted to graze the area's pastures.

The reserve consists of desert ecosystems – xerophyte and halophyte species, mainly Leguminoseae, Salsolaceae, Chenopodiaceae, and Graminae (Salehi, Unpublished results). Mammalian predators include Asiatic cheetah, striped hyena (*Hyaena hyaena*), gray wolf (*Canis lupus*), caracal (*Caracal caracal*), wild cat (*Felis silvestris*), common fox (*Vulpes vulpes*) and golden jackal (*Canis aureus*). Persian gazelle and wild boar (*Sus scrofa*) are the main wild ungulates with a small population of wild sheep in southern hilly terrains (Farhadinia and Absalan, 2004).

2.2. Behkadeh No Hunting Area

Designated as a No Hunting Area in 2006, Behkadeh NHA covers 23,000 ha located 130 km from Mane-Samalghan. It is composed of two plains (8600 ha) and mountainous (14,400 ha) biomes (Mansouri and Gordmardi, Unpublished results). The area is a part of a larger integrated area composed of Golestan National Park and Ghorkhod Protected Area. The overall area consists of mountainous habitat ranging in an east-west direction, surrounded by plains and Behkadeh NHA in the north.

The mean annual rainfall of 660 mm and mean annual temperate of 9 °C, produce temperate sub humid Mediterranean climates in the neighboring Ghorkhod Protected Area. Plant species such as astragal (*Astragalus* sp.) saltwort (*Salsola* sp.), and bean caper (*Zygophyllum* sp.) are found in the reserve (Darvishsefat, 2006). It is home to a diversity of mammalian carnivore species, including Asiatic cheetah, Persian leopard, brown bear (*Ursus arctos*), caracal, wild cat and gray wolf. Other than the goitered gazelle, mammalian prey such as Urial wild sheep and Persian ibex exist in the area (Farhadinia et al., 2009). Similar to Miandasht, domestic livestock includes goat (*Capra hircus*) and sheep (*Ovis aries*).

3. Methods

3.1. Scat collection

Field surveys were carried out from March 2004 to August 2009 in Miandasht WR and from September 2007 to August 2008 in Behkadeh NHA. The collection of scat from cheetah and other species and opportunistically observed kills made by cheetah was used in this research.

Since no information was previously available on the distribution of the cheetah in northeastern region of the country, preliminary distribution data were developed in each area based on camera trap pictures, tracks and verified local inquiries in order to search for more probable signs. Most of the cheetah habitats were regularly searched, particularly the valleys and dried watercourses where the cheetahs normally travel (Hunter et al., 2007). Since it is very rare for cheetahs to scavenge (Caro, 1994), unwitnessed kills were recorded only after verification based on tracks, hunting behavior, and killing method.

Cheetah scat was differentiated from that of other sympatric carnivores, like gray wolf, stripped hyeana, Persian leopard and small felids, by their typical cat-like "segmented" appearance and large size. We refrained from sampling at higher mountainous elevations (in Behkadeh), which are predominantly leopard habitat (Farhadinia et al., 2009), collecting any scat of white appearance (due to high bone contents, not because of old age) as more likely to be hyeana (Mills and Hofer, 1992), and any thick scat that had a diameter larger than 3 without a complete segmented cat-like shaped as more probably belonged to wolves (Waever and Fritts, 1979). Meanwhile, scats less than 20 mm in diameter were regarded as doubtful (e.g. lesser canids and lesser cats) and were left out of the analysis. Also, most of the cheetah scats were collected around trees where they normally use them as signing posts and defecate more regularly. Scat samples were sealed in plastic bags and labeled for location and date.

3.2. Scat processing

Once collected and labeled, scats were individually placed in nylon stockings and washed in hot water to remove surface oil. Then, they were washed, using a 1.5 mm sieve to separate the hair from other organic matter. No bleach or detergents were used. The washing process left in the stocking only hair, bones, teeth and hooves, and the stockings and their contents were then hung out to dry and hairs separated.

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3.3. Food item identification

To create slides for species identification, hairs were selected randomly from each sample, centered parallel on the slide, and mounted with cover slip using DPX mount. At least four slides were made per scat sample (n: 20 hairs/sample) following standardized procedure by Mukherjee et al. (1994). Slides were examined at 400× using a Leica microscope. Two authors (MSF and FHZ) were involved in the laboratory analysis in order to double check discrimination at a species level. Hairs were then identified by comparison with a collection of mammal hairs obtained from captive prey species, museum specimens, and kills, after examining their length, thickness, shape, and color. Features of cortex and medulla were compared with a reference collection prepared by Sepasi and Falahatkar (2006) microscopically. In compiling our reference collection, we were mindful of Keogh's finding that hair from fresh carcasses and preserved skins are identical (Buys and Keogh, 1984 cited in Marker et al., 2003). Rodents were identifiable based on remains, such as skull, bone and hair (Stuart and Stuart, 1993) and plant materials could be easily recognized.

3.4. Statistical analysis

For statistical quantification, each species found in one scat sample was assumed to characterize a single predatory event. We determined frequency of occurrence (percentage of total scats in which an item was found), percentage of occurrence (number of times a specific item was found as a percentage of all items found), and biomass of each prey species (Ackerman et al., 1984).

Because frequency tends to overestimate the importance of smaller items (Corbett, 1989; Floyd et al., 1978), we also estimated the biomass consumed using the correction factor $y = 0.0098x + 0.3425$, where y is the weight of prey consumed per scat and x is the total live prey weight (after Marker et al., 2003). This correction factor converts frequency of occurrence values for each taxon to a relative estimate of biomass consumption.

All material identified in each fecal sample were counted and multiplied by the average weight of the consumed item. To avoid counting certain prey more than once, we only considered certain structures for each taxon. However, due to impossibility to recognize the number of rodents, insects and vegetation, these were only included in descriptive analysis The average weight of each food item was obtained in the study area from the reference collections or sampling (livestock: Moghadam, 1993); hare: sampling ($n = 5$); goitered gazelle: sampling in neighboring Shir Ahmad ($n = 7$); wild boar (age between 5 and 12 months (Capitani et al., 2004)), because piglets are reported to be taken more frequently by cheetah than adults (Eaton, 1970).

For statistical comparisons, we pooled ungulate prey (i.e., goitered gazelle, wild boar and livestock) and categorized them into medium-sized food items, ranging within 15–60 kg in weight (Laurenson et al., 1992). We then pooled smaller food items (i.e., hares, rodents, reptiles, insects, and plant material) and considered them small-sized food items. We did not include non-food items (e.g. stone). Finally, likelihood-ratio contingency test (Williams, 1976) was used to determine if there was a difference in the frequency of the identified prey species between the two sites. Another test was done to test if there was a difference between the two food categories (medium and small-sized prey) between the two sites. We considered a test significant at the level of $P \leq 0.05$.

4. Results

4.1. Scat analysis

During the survey period, a total of 135 carnivore scats were found, of which only 58 were categorized as cheetah with 60% ($n = 35$) and 40% ($n = 23$) of these gathered in Miandasht and Behkadeh, respectively ($\chi^2 = 2.483$, df $= 1$, $p = 0.11$). The majority of scats were found on the ground (61%), but were also encountered under scrubs (22%) and trees (17%) (i.e., saxaul or tamarisk).

Based on these 58 scats, at least seven species/taxa have been known to be eaten by the cheetah. Accordingly, five groups of mammals were identified and their frequencies are presented in Table 1. The number of scats and food items were lower in Behkadeh than in Miandasht, by 12 and 18 respectively (Table 1). However, food items frequencies varied less in Miandasht than in Behkadeh (mean ± SE, 7.75 ± 2.53 and 5.5 ± 1.34). The most frequent food item in Miandasht was livestock, followed by plant material and rodents. The least frequent food items were hare and reptiles (Table 1). The same frequency pattern, with the exception of the goitered gazelle, was also observed in Behkadeh with insects being the least frequent item. All food items were shared between the two sites, with the exception of reptiles that were only observed in Miandasht and wild boar in Behkadeh (Table 1). Overall, medium-sized herbivores were the most frequently consumed food items by the cheetahs and occurred in 49% of all food items. In addition, we found remains of herbivores in 69% of the total

Table 1
Frequency of food items in scats of Asiatic cheetah in northeastern Iran.

Food item	Miandasht			Behkadeh		
	N	Frequency of occurrence (%)	Percentage of occurrence (%)	*N*	Frequency of occurrence (%)	Percentage of occurrence (%)
Medium-sized food items						
Goitered gazelle	9	26	15	9	39	20
Wild boar	0	0	0	5	22	11
Livestock[a]	20	57	32	9	39	20
Small-sized food items						
Hare	2	6	3	3	13	7
Rodents	12	34	19	8	35	18
Reptiles	2	6	3	0	0	0
Insects	3	9	5	1	4	2
Plant material	14	40	23	9	39	20
Non-food items						
Stone	2	6	3	3	13	7
No. of food items	62			44		
No. of scats	35			23		
No. of food items/scat	1.77			1.91		

[a] Domestic sheep and domestic goat.

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collected scats. Livestock remains had the highest frequency of occurrence followed by goitered gazelle in both study sites. Although not quantified, most scats containing livestock were gathered after winter when livestock are permitted to graze within the areas.

Among 25 food items of small mammals, hares composed a smaller percentage compared to rodent species (5% versus 20%) (Table 1). The likelihood-ratio chi square test was statistically significant when testing for association between study areas and prey species ($\chi^2 = 14.060$, df = 7, $p = 0.05$). However, when we compared the frequencies of food items per site there was no statistically significant difference ($\chi^2 = 3.057$, df = 1, $p = 0.08$).

We found remains of both gazelle and livestock in 11.5% of the subset of scats that contained a medium-sized food item in Miandasht, versus 26.3% for scats found in Behkadeh to contain these two medium-sized food items.

Table 2 presents the relative biomass of prey consumed and number of individuals based on number of collectable scat. Findings indicate a direct relation between weight of prey with number of scats and kilograms eaten with the exception of the wild boar, which despite having the highest weight was the least consumed (11%). In terms of kilograms, cheetahs consumed more livestock, followed by goitered gazelle, wild boar and hare. Nevertheless, when converted into number of individuals, more hares were consumed followed by livestock, goitered gazelle and wild boar (Table 2).

4.2. Direct observations

Cheetah prey base was also investigated based on a total of 23 observations under the three categories (i.e., on kill, successful hunting attempt and prey remains) observed throughout the study (Table 3).

The predators were seen on 4 (17%) kills and 13 (56%) reports of successful hunting attempts. The goitered gazelle accounted for the main proportion of 69% ($n = 16$) of direct observations and the cheetahs were occasionally seen eating terrestrial birds. A total of 12 gazelle remains were found (eight cases were verified as cheetah kills), of which five were sexed with a majority of them being males ($n = 4$, 80%).

In Behkadeh, almost all the cheetah hunting efforts were conducted by solitary animals; however, in Miandasht, they primarily hunt in groups, stalking through the dried watercourses or hilly terrains to get within a few dozen meters of the gazelle herds (often less than 10 individuals).

Table 3
Observation of the Asiatic cheetah while eating/killing prey in study areas.

Food item	Miandasht			Behkadeh		
	On kill	Hunting	Remains	On kill	Hunting	Remains
Goitered gazelle (*Gazella subgutturosa*)	2	5	5	0	3	1
Wild sheep (*Ovis orientalis*)	0	1	0	0	1	0
Livestock	1	0	0	0	2	0
See–See partridge (*Ammoperdix griseogularis*)	1	0	0	0	0	0
Chukar partridge (*Alectoris chukar*)	0	0	0	0	1	0

5. Discussion

5.1. Medium-sized prey

The Asiatic cheetahs in both Miandasht and Behkadeh have been seen preying mostly on goitered gazelles, but scat analysis revealed that the main proportion of the predator's diet is not based on the gazelles. Surprisingly, livestock presents the highest proportion of cheetah's food source in northeastern Iran, particularly in Miandasht. In most of the present cheetah habitats, the cheetahs inhabiting foothills and hilly terrains prey on mountainous ungulates, including the wild sheep (Farhadinia, 2004; Farhadinia and Hemami, 2010; Hunter et al., 2007). On the other hand, the wild sheep has been rarely seen to be hunted by the cheetahs in the two plain-hilly areas. Difference of food habits between two study areas can be associated with lower density of the gazelles in Miandasht (less than 0.37 comparing to 0.65 per square kilometer in Behkadeh) (Department of the Environment, 2009) and probably the cheetahs' higher abundance in previous site.

Our data shows that the wild boar was the least consumed prey in study, despite Behkadeh and Miandasht being the only verified habitats where cheetah and wild boar inhabit. This suggests that it is a non-regular prey for cheetahs in Iran. This is supported by studies in Africa, that have shown warthog (*Phacochoerus africanus*) not be a preferred prey by cheetahs in Africa (Hayward et al., 2006; Mills et al., 2004) but rather a rare food item usually taken only as piglet (Eaton, 1970; Marker et al., 2003).

5.2. Depredation on livestock

Based on scat analysis and direct sighting, our data definitely confirm that the Asiatic cheetah prey on livestock. Presence of livestock throughout the majority of the areas during winter grazing season causes gazelles to be scattered across the habitat (Farhadinia et al., 2009), potentially leaving the cheetah few prey options other than livestock. Conversely, fecal sampling of Namibian cheetahs revealed that domestic small-stock comprised a small proportion of the cheetah diet on farmlands (Marker et al., 2003; Wachter et al., 2006).

Meanwhile, depredation on young camels has been widely reported by local people in Miandasht (Jourabchian, Unpublished results). A few fresh young camels were reported suffocated and their liver was eaten, however, only wolf tracks were found around the kills (Harati, Personal Observation).

It is difficult to estimate rates of livestock predation due to cheetahs from this study (i.e., limited data set). Based on a questionnaire research during the survey period, it was reported

Table 2
Estimated biomass consumed for mammals in scats of Asiatic cheetah in northeastern Iran.

Prey item	Assumed weight of prey (kg)	Prey per scat	No of scats	Kg eaten	Biomass (%)	Ratio of weight eaten to livestock	No. of individuals eaten	Ratio of no. individuals eaten to livestock
Goitered gazelle	20.6	0.54	18	9.80	28%	0.49	0.48	0.77
Wild boar	26.8	0.61	5	3.03	9%	0.15	0.11	0.18
Livestock	35	0.69	29	19.88	58%	1.00	0.57	0.92
Hare	3	0.37	5	1.86	5%	0.09	0.62	1.00

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calculated that each herder lost an average of 0.9 (±1.7) during 2004–2005 and 4.23 (±7.0) sheep for 2008–2009 grazing seasons to predators in Miandasht. Almost all the herders attribute the predation to wolves with a few claims of losing livestock to the cheetahs. In Behkadeh, the same perception exists among the herders (Farhadinia & Nezami, Unpublished results). However, since the cheetah exist at low densities and most of the herders have never encountered a cheetah in the wild, herders are often unaware of the alternative predators and attribute the losses to wolves. In Botswana, one third of farmers reported livestock loss to cheetah annually, but thirty-nine percent of the farmers who reported livestock losses to cheetah could not identify when this depredation had taken place (Selebatso et al., 2008), indicating that this elusive predator tries to remain unseen during attacking to livestock.

Throughout our research period, despite evidence of livestock depredation, there was only one unconfirmed report of a cheetah being killed by herders in defense of livestock. In other areas of the cheetahs' range this is a large problem, despite the apparent lower levels of predation than here (Marker et al., 2003; Marker-Kraus et al., 1996; Mills, 1991; Selebatso et al., 2008). Low density and encounter rate of the cheetahs in these areas as well as unfamiliarity of local people to the cheetahs who traditionally relate livestock depredation to the wolves might be the main reason for low level of retaliatory killing of the cheetahs. In Iran, the cheetah also has the highest level of law protection with a penalty of around $10,500 (exchange rate of April 2012) for killing a cheetah, which may further deter herders from taking lethal action.

5.3. Small-sized prey

Rodents comprise part of the cheetahs' diet and were present in the similar proportions of scats in both habitats. In Namibia, hares and small mammals were also found to be a large part of cheetah diet (Marker et al., 2003; Wachter et al., 2006). Most of rodent species (Muridae and Dipodidae) in the study areas weighted less than 100 g (Ziaie, 2008) which reveals high energy expenditure for the cheetahs they need to spend to catch enough amounts of rodents.

Ranging from 1.5 to 4 kg in weight (Dareshuri and Harrington, 1976), hare has been widely cited in literature as comprising a main proportion of cheetah's diet wherever ungulates occur in low density (e.g. Karami, 1992; Ziaie, 2008). However, scat data revealed that it would be an occasional source of food for the cheetahs in Iran and may be too small to sustain cheetahs (especially females with cubs) (Hunter et al., 2007). In Africa, hares (*Lepus* spp.) were found to be common prey for the cheetahs in studies based on scat analysis (Marker et al., 2003; Wachter et al., 2006). Meanwhile, they were less regular in direct sighting evaluation (Eaton, 1970; Mills et al., 2004), resulting in apparent avoidance in the cheetah diet (Hayward et al., 2006). However, the cheetah has the highest hunting success rate for the hare, calculated as 88% in Serengeti, but only 27% success on the main ungulate food prey, Thomson's gazelle (*Gazella thomsoni*) (Caro, 1994).

Our study areas hold high density and diversity of avifauna, particularly ground dwelling species such as black-bellied sandgrouse (*Pteroceles orientalis*), Houbara bustard (*Chlamydotis undulate*), chukar (*Alectoris chukar*) and see–see partridges (*Ammoperdix griseogularis*) and there are occasional sightings of cheetah hunting these birds (Farhadinia and Absalan, 2004). However, no evidence of predation on birds was found in either area based on scat analysis, suggesting that birds play a non-significant role in the cheetah diet, even where natural prey has drastically depleted. In Africa, cheetah hunting bustard species have been observed (Caro, 1994; Dragesco-Joffe, 1993) and a cheetah has been observed to prey on a bittern in Egypt (Saleh et al., 2001).

Although small sample size prevents firm conclusions, the predominance of male gazelles among cheetah kills in both study areas is in accordance with other studies of prey selection of cheetah in Africa (e.g. Thomson's gazelle in Serengeti (Fitzgibbon, 1990); springbok (*Antidorcas marsupialis*) in Kalahari (Mills, 1990) and impala (*Aepyceros melampus*) in Kruger (Mills et al., 2004)). Additionally, Farhadinia and Hemami (2010) have also noted the same conclusion for the Asiatic cheetah in central Iran. Fitzgibbon (1990) describes how male gazelles are more vulnerable than female and preferentially selected by cheetahs because they tend to occur on the periphery of groups, have greater nearest-neighbor distances, are less vigilant and are found in smaller groups than females.

5.4. Management implications

Our data indicate that the Asiatic cheetah mainly feeds on medium-sized herbivores in northeastern Iran. Small mammals, particularly hares that have been recently mentioned as the main food item (Ziaie, 2008) do not seem to be a significant source of nutrition. It was a controversial issue among some Iranian conservationists that wherever there is scarce wild herbivore prey, cheetahs would live on hares which have a high reproductive potential. The present investigation indicates that wherever the prey base of the cheetahs has depleted (i.e., wild bovids), the cheetahs need to find alternative sources of food among herbivores and occurrence of livestock depredation would be highly expectable. This is in spite of the fact that the cheetahs appear to show selection toward game species rather than livestock wherever wild prey is available (Marker et al., 2003). The wild prey base available to the cheetah is critical in the issue of predator conflict, as a plentiful wildlife population provides an abundance of prey, which in turn reduces the conflict with predators (Marker et al., 1996). Therefore, enforced regulations are extremely needed to control the decrease of game populations within cheetah habitats due to poaching.

Also, preserving a core zone of no grazing permission to exclude livestock is considered to be a significant step to prevent dispersal of the gazelles during winter's herds presence in the area.

Since the local herders seem to be unaware of the cheetah's depredation of their stock, we strongly recommend that herders should be empowered to reduce their loss to the predators; however, we should proceed carefully and cautiously to avoid any probable increase in their expectations of predation and even cause poaching by herders. Meanwhile, any solution to the problem could also include education and raising awareness to maintain positive attitudes and increase tolerance. Such an approach has proved successful in raising the tolerance of cattle ranchers in Namibia toward cheetah, and reducing persecution (Marker et al., 2003).

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