

Litter sizes of brown bears in the Central Alborz Protected Area, Iran

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Abstract: Although smaller than 4,000 km², the Central Alborz Protected Area (CAPA) is one of the main habitats of brown bear (*Ursus arctos*) in Iran. During August 2005 to September 2009, we gathered data through direct observations of bears, identifying individual bears by means of age, sex, color, and behavior. We observed bears on 115 occasions. Mean size of cub litters was 2.00 (SE = 0.20, $n = 13$) and varied from 1 to 3. We speculate that low occurrence of meat in food items of the bears in the area explains this relatively small litter size. We hypothesize that the north-central portion of the Alborz Protected Area is a female core area which supports surrounding sink populations and needs to be protected more effectively.

Key words: brown bear, Central Alborz Protected Area, Iran, litter size, *Ursus arctos*

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The brown bear (*Ursus arctos*) is continuously distributed in northern and western portions of Iran, mainly in the Alborz and Zagros Mountains (Lay 1967, Gutleb and Ziaie 1999). The Alborz Mountains are thought to hold a larger number of bears than the Zagros to the west (Etemad 1985, Gutleb and Ziaie 1999, Farhadinia et al. unpublished data), with a rough estimate of 500–1,000 bears (Gutleb and Ziaie 1999). Hosting one of the largest populations of the Syrian brown bear in Iran (Nezami 2008), western Mazandaran province, including the Central Alborz Protected Area (CAPA), has been widely considered in the literature to have reliable evidence of bear presence (e.g. Blanford 1876, Goodwin 1940, Misonne 1959, Lay 1967). However, scientific data on brown bears are scarce in Iran, especially on population size and reproductive

aspects of the species. Additionally, brown bear conservation has not been properly considered in management plans for protection of the area (Iranian Department of Environment 2001).

Estimating population size and trends of brown bear populations has frequently been based on tallying the number of females with cubs observed annually (Knight et al. 1995, Palomero et al. 1997) and is central to evaluating conservation measures. Family groups are an important portion of the population and are the most important demographic component (Palomero et al. 1997). Monitoring females with cubs provides information about demography and contributes to their surveillance and protection (Knight et al. 1995).

Aside from its intrinsic importance for conservation as a large carnivore protected by law (Farhadinia et al. unpublished data), the Iranian brown bears occur in habitats where there is relatively high diversity of fauna, such as Persian leopard (*Panthera pardus saxicolor*), maral red deer (*Cervus elaphus maral*), roe deer (*Capreolus capreolus*), Eurasian lynx (*Lynx lynx*), and wolf (*Canis lupus*) (Darvishsefat 2006, Ziaie 2008). Because the brown bear distribution overlaps major ecosystems in CAPA, the species is considered an umbrella species (Carroll et al. 2001); focusing conservation efforts on it can provide effective conservation management for the vanishing forest habitats of Iran.

The size and frequency of litters and the survival of cubs are important parameters of population change (Frković et al. 2001), and monitoring these parameters can help managers evaluate protection effectiveness. Thus, we investigated litter sizes in a brown bear population in the northern portion of CAPA in Iran during 2005–09. We hope this will provide part of a scientific base for monitoring efforts within bear habitats, particularly areas with relatively long conservation histories.

Study area

Stretching across the southern shore of the Caspian Sea in an east–west direction, the Alborz Mountains are home to a number of the well-known reserves of Iran, including CAPA (Fig. 1). One of the oldest reserves in the country, CAPA was designated as a protected area in 1963 with an area

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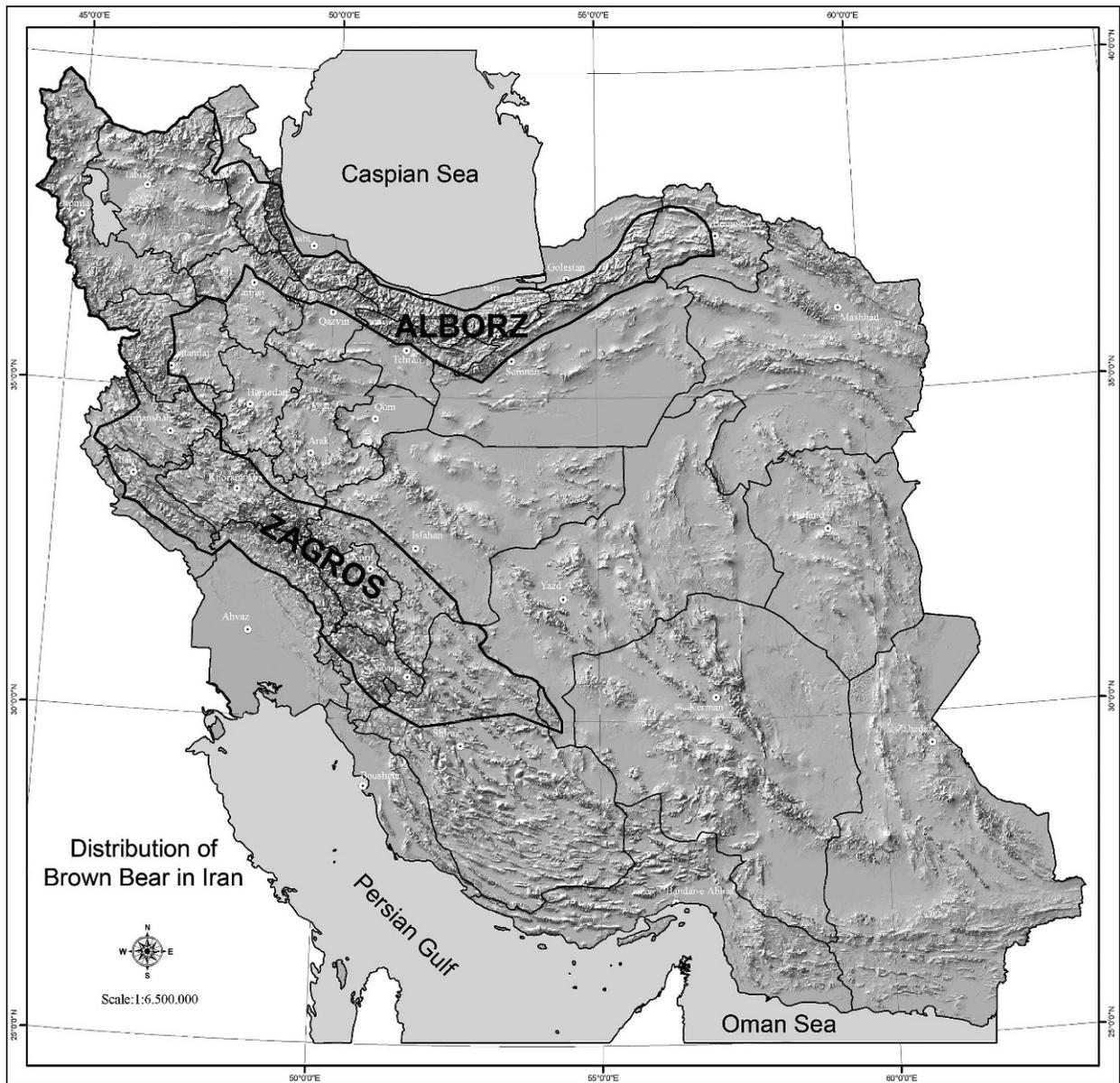


Fig. 1. Distribution of brown bear in Iran, 2010 (heavier black lines).

of $<4,000 \text{ km}^2$ (Darvishsefat 2006); the approximately 5,000-ha core zone of CAPA, in Mazandaran province, is the location of this study (Fig. 2).

The study area consisted of various ecosystems, from Irano-Turanian landscapes in the south to highland alpine scrublands extending to deep Hyrcanian forests near the Caspian Sea, with elevations ranging from -10 – $4,300 \text{ m}$. The mean annual temperature of 8 – 17°C and precipitation of 350 – $1,100 \text{ mm}$ result in temperate pre-humid, cold

humid, temperate semi-arid, and warm Mediterranean climates in the region (Darvishsefat 2006). High mountains and forests are covered by heavy snow from December to March and are not accessible during these times.

Due to its exposure to the Caspian Sea, its humid northern slope is predominantly covered with dense Hyrcanian forests. The main plant species include beech (*Fagus orientalis*), hornbeam (*Carpinus betulus*), chestnut-leaved oak (*Quercus* spp.), scotch elm

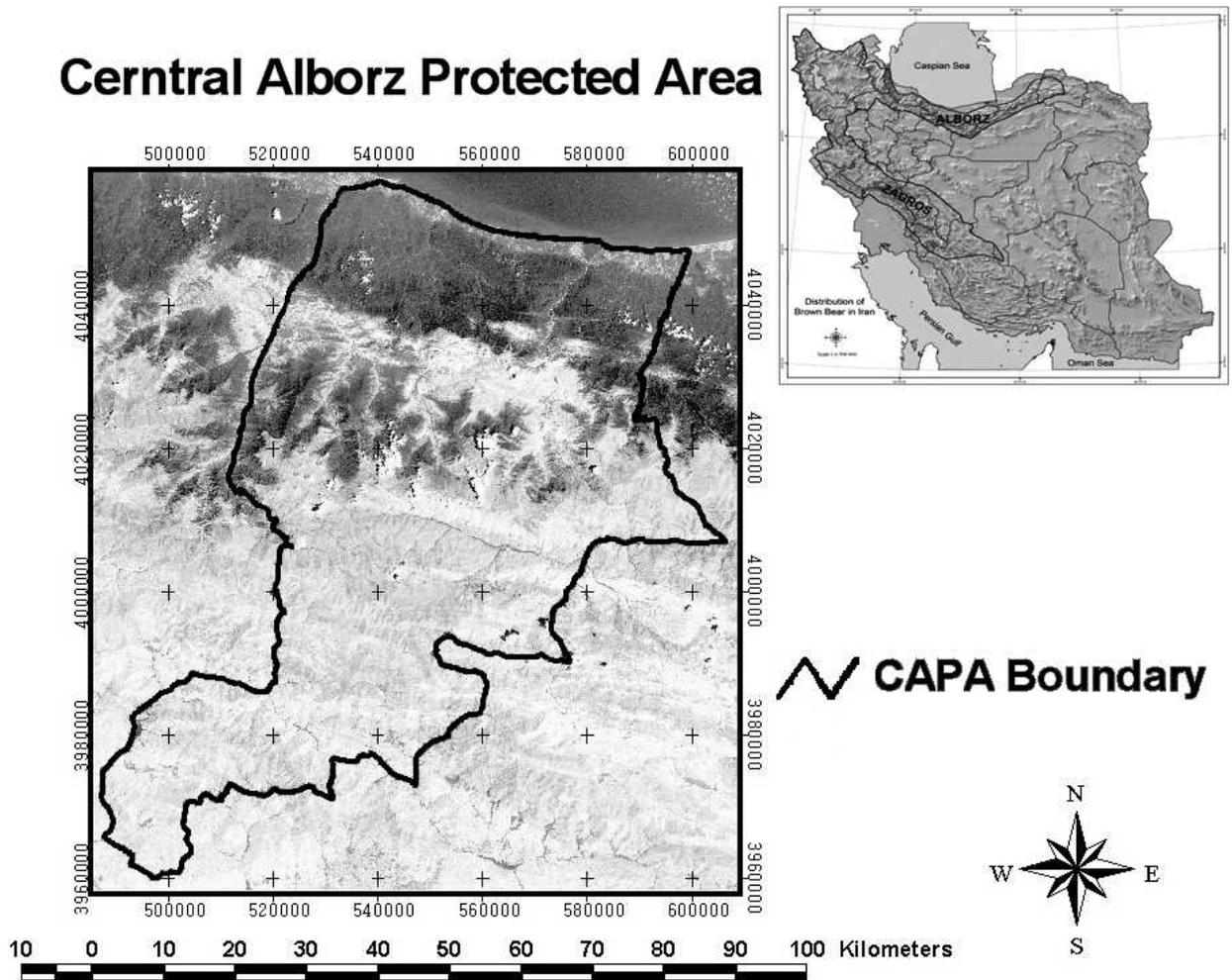


Fig. 2. Central Alborz Protected Area and its location in Iran.

(*Ulmus glabra*), alder (*Alnus* spp.), lime tree (*Tilia* spp.), *Astragalus* spp.), and various graminoids.

Methods

Field investigations were carried out from August 2005 to September 2009 in the CAPA, mainly in the Core Zone. Field surveys were conducted monthly until May 2007, but afterward surveys were conducted only during June and July, during which time we noted that bears mainly occupied high elevations and were easier to document. Data were collected mainly on mountains peaks and ridges where visibility was good, or along 6 main transects throughout the area.

Information on number, age (i.e. cub, yearling, and adult), time, location, habitat, and behavior

were recorded upon sighting a bear. The bear's color was also considered which, together with other age–sex characteristics, we found helpful in individual identification over short periods. These characteristics have been used in other brown bear studies as a tool to recognize individuals through time (Sellers and Aumiller 1994, Craighead 2000, Nawaz 2008).

We used 2 pairs of 12x binoculars to observe bears (simultaneous observation by both authors). To aid in differentiating individuals and minimize duplication, we photographed bears using a camera equipped with a 75–300 zoom lens. To enhance the reliability of individual identification, animals were carefully watched from a location without any disturbance to the bears, resulting approximately 2,900 minutes of direct observation during the study.

Herein, we report only on bears systematically recorded by us; we did not accept bear sighting notes made by game wardens nor by other experts or students in the area. In total, we considered 34 observations duplicates and excluded them from calculations. We are aware that duplicate observations may have been undetectable by our methods, but we believe the number of duplicates to be low and unlikely to bias our results. Individual comparison was conducted between animals seen in each year's sampling; however, we avoided comparing bears between years, because color changes with age (Nawaz 2008).

Results

We observed bears on a total of 115 occasions during the 4-year study, of which 91% occurred in the 3 summer months, and most were in high elevation habitats. We identified what we believe to have been 22 bears in 2006, 24 in 2007, 19 in 2008, and 14 in 2009. Despite continuous field surveys prior to May 2007, we observed no bears during either autumn or winter. However, we did encounter fresh tracks and scars, and believe our failure to see bears at these times may have been because of the difficulty of observing them while they occupy dense forest. Among sighting in which groups of bears were seen, 86% were family groups.

We observed 19 different family units, of which 13 consisted of females with cubs of the year (Table 1). Litter size varied from 1 to 3 and averaged 2.0 (SE = 0.20).

Discussion

The mean litter size we documented in the northern portion of the Core Zone of CAPA was lower than 2.39 and 2.4 cubs documented in Croatia (Frković et al. 2001) and Scandinavia (Swenson et al. 1994), respectively. However, our mean litter size was not as low as 1.8 (west population) and 1.5 (east

population) in Spain's Cantabrian Mountains (Palomero et al. 1997), or the 1.33 in the Himalaya of Pakistan (Nawaz 2008).

According to Bunnell and Tait (1981), nutrition is the primary factor regulating reproductive parameters in bears. Mammals are believed to be the highest quality food throughout the year for bears (McLellan and Hovey 1995, Hilderbrand et al. 1999), and abundant meat resources positively affect reproductive success in bears (Hilderbrand et al. 1999). It has also been reported for the Himalayan brown bears that their small litter size is related to their predominant vegetarian diet with low meat content (Nawaz 2008). We speculate that bears in our area lack meat in their diet (Nezami and Farhadinia unpublished data), because we believe that they have difficulty preying on the native large mammals such as wild goat (*Capra aegagrus*), red deer, and wild boar (*Sus scrofa*), which are more agile than are bears in the high, rugged mountains of the CAPA. Most family groups were observed near cliffs or rocky terrain.

Females with young have rarely been observed in the South Alborz Protected Area, located south of our study area (E. Jannati, Iranian Cheetah Society, unpublished data; Ataei 2010). Therefore, we speculate that the Core Zone of CAPA may function as a core area for females (Swenson et al. 1994).

Conservation recommendations

Reproductive parameters are important for management of brown bears; we thus believe our results can form a useful baseline for monitoring of bear populations in Iran. We recommend that the Iranian Department of Environment conduct similar surveys in other bear habitats in the country to evaluate protection measures, comparing them with our study area, which we believe has the highest density of bears in Iran. We also recommend enhancing conservation measures (e.g., game wardens) to

Table 1. Brown bears observed in the Central Alborz Protected Area, Iran, 2006–09.

| Year | Sighting events | Unique bears identified | Females with cubs-of-the-year | Cubs | Mean litter size |
|-------|-----------------|-------------------------|-------------------------------|------|------------------|
| 2006 | 38 | 22 | 2 | 5 | 2.5 |
| 2007 | 37 | 24 | 3 | 6 | 2 |
| 2008 | 21 | 19 | 4 | 9 | 2.25 |
| 2009 | 19 | 16 | 4 | 6 | 1.5 |
| Total | 115 | 81 | 13 | 26 | 2.0 |

secure this female core area. Other populations should be explored to examine possible connectivity with this one. Our findings should be integrated into regional and local management plans to avoid loss of habitats in northern Iran, which are now seriously threatened by development plans.

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