Abstract

In this paper we study the movement behavior of Asiatic cheetahs (Acinonyx jubatus venaticus), a highly endangered subspecies found in Iran. At first, we fitted the generalized correlated random walk model to the data; to estimate the probability of the behavior of the animal in two distinctive states. The moving state can be interpreted as the state when the animal had higher mobility and the resting state in which the animal had small step movements and constantly changes its direction.

We considered a movement and observation model; we used the observation model to model the error associated with the GPS sensors. We employed the Bayesian framework for the model fitting in which the Markov Chain Monte Carlo (MCMC) simulation enabled us to estimate as many parameters found in the posterior distribution.

The movement track was collected spanning four and a half months in 2007; probably, the cheetah was predated by a leopard after that period. The animal was monitored in Bafq area, a region in the central Iran with an arid environment. Plotting the animal track symbolized by the two behavioral modes revealed that the cheetah had most mobility between four clusters of resting phases. Applying the k-means clustering to the cheetah’s resting locations, revealed that the cheetah had more mobility between eight clusters of resting phases. One speculation was that, these resting clusters were associated with the highest likelihood of prey concentration as cheetahs major prey, wild sheep, and goat, reside in these regions.

Objectives

- Estimate the movement behaviors (resting and moving) of the cheetahs only using the movement track.
- Look for any interesting pattern in the movement behavior i.e.,
- Estimate the resting location clusters of the cheetah.
- Find correlation between the behavior and the time of day associated with behaviors

Cheetah Data

- Two male (brother) cheetahs (age 3-5) were captured using foot snare.
- The collars were set to transmit locations every 10 minutes.
- Almost all remotely sensed movement data exhibits some gaps.
- Options to deal with the gaps include interpolating the consecutive missing points using weights averaging, or sub-sampling the data to the largest gap (24 h).

Study area

- The cheetah study was conducted in the Bafq protected area in central Iran, one of five protected areas identified by the Conservation of Cheetah Project (CCAP) as the most important areas for cheetah.
- Bafq is barren area of land characterized by desert with scarce rainfall, high temperature and degraded landscapes.
- It is surrounded by human infrastructure such as cities, villages and highways that exacerbate the situation for cheetah dispersal.
- A large number (7 out of 50-70) of Asiatic cheetahs have been lost due to vehicle collisions in the region over the last decade.

Method

1. Cheetah movement tracks
2. Display on top of Google satellite imagery
3. Select the use with the Google snare tool
4. Extract the resting locations
5. Complete more nests and look for

We considered just two states: a moving state consisting of relatively fast and more directionally persistent movement (also known as moving state), and a resting state consisting of relatively slow movement with frequent course reversals, also known as the encamped state.

Behavioral bout summary

The longitude and latitude profiles could be used as a mean to visually inspect the changes in the both direction to check whether the animal is moving or resting.

The diagnostics plots of the estimated parameters of the DCRWS model from the posterior distribution of MCMC sampler.

The estimated resting clusters, using k-means clustering, superimposed on top of Google satellite imagery.

In a very exceptional event, the cheetah entered into moving phase for straight 14.5 days and traveled 130 km within the same reserve.

$$x_t = x_{t-1} + v_t + N(0,2)$$

Discussion and Conclusion

Asiatic cheetahs are truly a unique species in the animal kingdom. This is the only species in the animal kingdom that can successfully hunt for large mammals. However, the Asiatic cheetah has fitness challenges in this area due to the harsh and arid conditions of the area. In this study, we found that the frequency of being in each behavioral state indicated that the cheetah tended to be in moving phase from 00:00 to 16:00, although the frequencies of being in both movement phases are roughly equal in the evening (16:00 to 00:00). The Chi-square goodness of fit test was not significant.

References


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