

Movement and activity pattern of a brown bear (*Ursus arctos* L.) tracked in Central Balkan Mountain, Bulgaria

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Abstract. First data about movement of brown bear in Bulgaria, based on 10 days tracking period of female without cubs on the territory of Central Balkan, Stara planina Mountain. Bear is active 46% of a 24-hour period, traveling 4 km per day in average. Speed is varying in different habitats and is up to 6.5 km/h in the grasslands.

Key words: *Ursus arctos*, brown bear, movement, speed, Central Balkan Mountain.

Introduction

Little is known about the movement and activity of the brown bears in Bulgaria. Knowledge so far is empirical, gathered from observations made by hunters, game breeding specialists or zoologists (Peshev *et al.* 2004, Spassov 2007). Most of the knowledge is based on assumptions because bears are hard to observe and follow. When alarmed by human presence they change the rate of movement or try to hide, which changes the behaviour and biases the results (Nellemann *et al.* 2007, Martin *et al.* 2010, Ordiz *et al.* 2013). In this case GPS telemetry is valuable method giving accurate data and avoiding bear's disturbance and change in behaviour.

The censuses of bears in Bulgaria that have been done by counting bears on high stands without taking in account the movement and activity characteristics of the species gives poor results and biases the study. Bear's activity and movement patterns are one of the main sources of information about the bears ecology and use of habitat. It is very important when management decisions have to be made.

The aim of the study is to determine the traveled distance, average speed and movement through different habitats by GPS-collared female bear in Bulgaria.

Material and Methods

The study includes data collected from 1 animal with GPS-GSM collar (Vectronics, model GPS PRO Light-3) in the period 2007-2008.

The bear is 3-4 year old, female without cubs, caught on the territory of Central Balkan Mt., Mazalat Game Breeding Station (Mazalat GBS).

The animal was caught with Aldrich foot snare close to high stand in the Mazalat GBS, with maze as bait. It was tranquilized with dart gun with 500 mg Zoletyl and fitted with GPS collar with adaptable rate of GPS-locations (fixes) take-down.

For the presented study 10 minutes intervals between fixes for 10 days period were taken (13.06.2008 - 22.06.2008). For the calculation of the animal movement speed between two fixes, the path traveled is divided by time interval of 10 min and recalculated to kilometer per hour.

The time interval between 06:00 and 21:00 was assumed as diurnal activity and for nocturnal activity - the interval between 21:00 and 06:00.

All locations with stationary behavior (sleeping or feeding on concentrated food source) were excluded from the analysis on the following basis: all locations 10 m or less from one another were considered inactive because of the GPS-error and a “cloud” of fixes in a 10 m radius (20 m in diameter) shows stationary behavior.

For distance traveled and speed in different habitat types only the path within the habitat was taken into account. Transitional segments (when the start point and end point are in different habitats) were excluded from the analysis, because the time of the transition cannot be identified properly.

Results and Discussion

Bear's activity, distance traveled and speed

Bears are active both during the day and the night. The pattern of rest and activity is complex and is determined by a lot of factors (type and availability of food sources, disturbance, weather conditions, intra- and interspecies relations, etc.).

During the study period the tracked bear was active average 6h 40 min during the day (44.2 % of the time; min 4h 20 min; max 9h 10 min) and 4h 30 min during the night (50.6 % of the time; min 2h 50 min; max 4h 50 min). Average distance traveled was 2.3 km (2322 meters; min 1431.8 m; max 3695.6 m) for the daytime and 1.7 km (1661 m; min 224.2 m; max 3842.5 m) for the nighttime. Average 24-hours distance traveled was 4 km (3984 m; min 2216 m; max 5675.8 m).

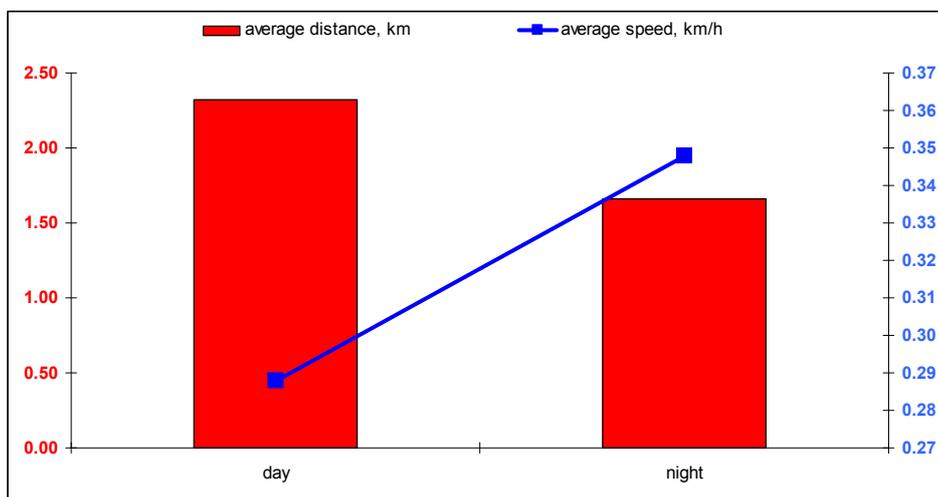


Fig. 1 Average speed and distance traveled.

Average day-time speed is lower than night-time speed, but the average distance traveled is higher. This relates to slow, but constant animal movement during the day. Resting is short in duration but on a numerous different locations. During the night the movement is fast, but the distance traveled is shorter which indicates relatively quick movement between points of interest and longer stationary feeding or resting behavior (Fig.1).

Average speed in different habitat types

Within the study period the tracked bear uses three habitat types: broad-leaved forests, natural grasslands, and transitional woodland/shrub according to Corine land cover nomenclature (Commission of European Communities 1994).

The bear moves with different speed in different habitats, fast in the grasslands (average speed 1.2 km/h), slower in the forest (average speed 0.7 km/h), and slowest in the shrubs (average speed 0.3 km/h) (Fig. 2).

The lowest speed is observed in forests and grasslands. This is determined by the fact that bears often feed in these habitats, slowly moving and picking berries, turning stones or logs in search of insects, etc.

The highest speed is observed in the grasslands (2.4 km/h) which is determined by the animal's strive to pass through uncovered areas as quickly as possible (Stelmock & Dean 1986).

Broad-leaved forests in the region are generally beech forests, which provide more cover than the grassland, but less than coniferous forest or shrubs. Animals can move through it easy but not as fast as in the open grassland. The average speed in this habitat is 1.45 km/h.

Bear's speed in transitional woodland/shrub is constant and slow. This is determined by the fact that the minimum and maximum speed are in close margins, and average speed is lower than average speed in the forest or the grassland. Bear is moving through the shrubs with constant low speed, picking berries or hiding.

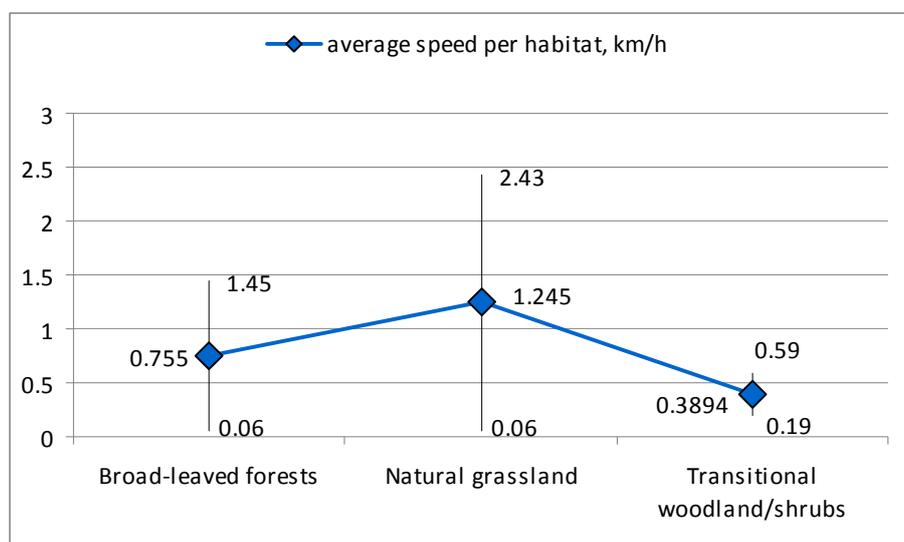


Fig. 2. Minimum, maximum and average speed of the bear in different habitats.

Top speed of the bear is 6.53 km/h measured when bear traveled between two forest patches through grassland during the night (22:40-22:50). These results are similar to those of Croatia (Huber & Roth 1993) and Greece (Merdzanis 2008).

Conclusions

Bears have flexible activity and can be diurnal, nocturnal or crepuscular in different situations. Bears are active around 50% of the time.

Bears use different habitats in search of food, shelter, denning, which affects the bear's speed and movement.

Fastest movement is in the grasslands especially when passing between forest patches. It is in order to pass quickly through dangerous habitat or to reach desirable location faster.

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