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Research Article

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Camera-trap records of breeding Eurasian lynx (*Lynx lynx*) at the Mount Ilgaz Wildlife Reserve

Ilgazdağı Yaban Hayatı Geliştirme Sahası'nda Vaşak (*Lynx lynx*) Üreme Kayıtlarının Fotokapan Yöntemiyle Tespit Edilmesi

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ABSTRACT

Breeding seasons are one of the most important periods for the life cycle of large mammals. The young individuals of large carnivore mammals are usually dependent on the female for food and protection. Therefore, availability of the sources and human disturbance at the breeding site are critical for a successful breeding season. The breeding site is of vital importance to the survival of the new-borns and thus to the trends in the population size. The present study assesses the breeding records of the Eurasian lynx (*Lynx lynx*) based on camera-trapping surveys at the Mount Ilgaz Wildlife Reserve in the province of Kastamonu. The surveys were conducted continuously over a four year period (2014-2018) and the results indicate that the camera-trap stations, which detected the cubs of Eurasian lynx, have also been used by the juvenile individuals of two other top predator large mammals, brown bear (*Ursus arctos*) and grey wolf (*Canis lupus*) and the juveniles of their prey species, red deer (*Cervus elaphus*) and brown hare (*Lepus europaeus*). Consequently, further assessment of the Wildlife Reserve Area considering the breeding records of the large mammals will contribute to have more effective protection for the Eurasian lynx and other wildlife populations in the Western Black Sea Region of Anatolia.

Key Words

Camera-trap surveys, nature conservation, reproduction, wildlife.

ÖZ

Üreme mevsimi, büyük memelilerin yaşam döngüsü için en önemli dönemlerden biridir. Büyük karnivor memelilerde yavrular, korunma ve beslenme gibi en temel yaşamsal ihtiyaçlar için genellikle dişiye bağımlıdır. Bu nedenle, üreme alanındaki mevcut kaynaklar ve olumsuz insan müdahale derecesi üreme mevsiminin başarısı için kritik öneme sahiptir. Üreme bölgesi, yeni doğan yavruların hayatta kalması ve dolayısıyla populasyon büyüklüğündeki eğilimler için hayati öneme sahiptir. Bu çalışmada, Kastamonu ilindeki Ilgazdağı Yaban Hayatı Geliştirme Sahası'nda Avrasya vaşağının (*Lynx lynx*) alandaki üreme kayıtları 2014-2018 yılları arasında kesintisiz sürdürülen fotokapan örneklemeleri ile tespit edilmiştir. Çalışma sonuçları, vaşak üreme kayıtlarının elde edildiği fotokapan istasyonlarının, alandaki diğer iki büyük predatör memeli olan bozayı (*Ursus arctos*) ve kurt (*Canis lupus*) yavruları ile kızıl geyik (*Cervus elaphus*) ve yabani tavşan (*Lepus europaeus*) türlerinin yavru bireyleri tarafından da kullanıldığını göstermektedir. Tespit edilen üreme kayıtlarının Yaban Hayatı Geliştirme Sahası'nın sonraki değerlendirme planlarında dikkate alınması, Batı Karadeniz'deki Avrasya vaşağı ve diğer yaban hayatı türlerinin daha etkin bir şekilde korunmasına önemli ölçüde katkıda bulunacaktır.

Anahtar Kelimeler

Fotokapan, doğa koruma, üreme, yaban hayatı.

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INTRODUCTION

Large mammal species are among the priority groups for conservation programmes throughout the world. The threats, mainly based on human activities, cause major problems for the survival of these wildlife populations [1,2]. Several large mammal species have been extinct and the population size of many species has severely decreased in recent centuries [1,3].

The low reproduction rate of carnivore mammals increases the risk of their population size continuing to decline; therefore, an effective and successful breeding season is essential for the existence of these populations [4]. Most large carnivore mammal species have one litter every one or two years with an average litter size usually between 3 to 5 [5], and the resource availability in the region has an important effect on the breeding success of carnivore mammals [6].

The mating season for the Eurasian lynx (*Lynx lynx*) is from January to April in general [7,8] and the gestation period range is between 54 and 73 days [9]. They breed only once a year, but after a successful breeding, the female usually does not breed for the next two years [7]. The average litter size is 2-3 individuals, but it can vary from 1 to 5 [7,8,10].

The females of the Eurasian lynx are responsible for the parental care and the cubs are dependent on the female for their food and protection [7], which increases the importance of the breeding site. Because of the dependence of the cubs and their demands, a breeding area with sufficient resources, such as food and hiding places, is a necessity for the breeding female [6]. The low movement ability of the cubs for the first few months limits the movement distance of the female [11]; therefore, an undisturbed area and resource availability are crucial to a breeding site [12].

The Eurasian lynx has a wide distribution range from Europe to Asia [9,13,14], including several regions in Turkey [15-18] (Figure 1). Mount Ilgaz in the Western Black Sea Region of Anatolia is one of these areas supporting

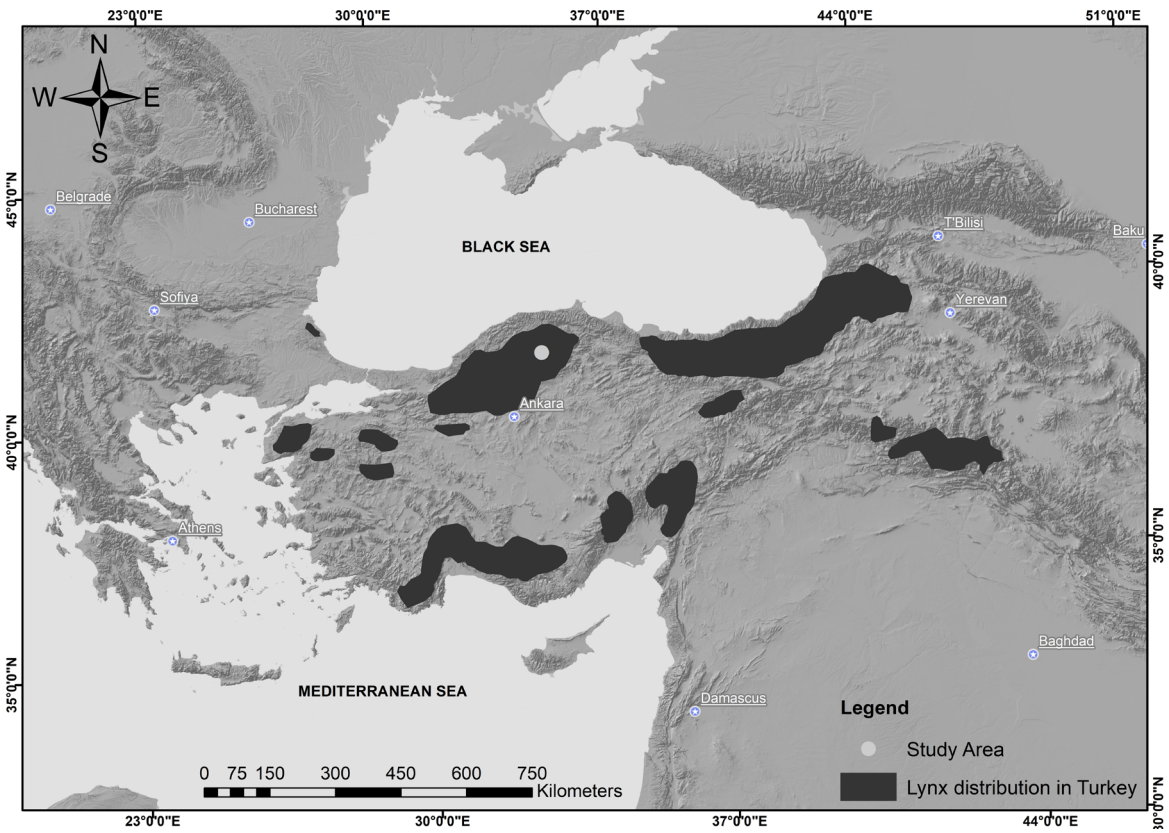

Figure 1. Distribution of the Eurasian lynx in Turkey (modified from Turan, 1984 [16] and Breitenmoser et al., 2015 [14]), and the location of the study area at the Mount Ilgaz Wildlife Reserve.

a Eurasian lynx population [19]. A protected area called the Mount Ilgaz Wildlife Reserve is located at this mountainous area in the province of Kastamonu. The present study reveals the breeding records of the Eurasian lynx population in the Mount Ilgaz Wildlife Reserve based on camera-trapping data and presents implications for improving its conservation.

MATERIALS and METHODS

Study Area

The study area, which covers 108 km^2, was at the north-eastern part (33°44'51''–33°55'04''E; 41°04'02''–41°10'35''N) of the Mount Ilgaz Wildlife Reserve, and it is located in the province of Kastamonu in the Western Black Sea Region of northern Anatolia (Figure 1). The area has a temperate oceanic climate [20] and is covered with forest dominated by Caucasian fir (*Abies nordmanniana*), Scots pine (*Pinus sylvestris*), black pine (*Pinus nigra*), and Oriental beech (*Fagus orientalis*). The highest elevation of Mount Ilgaz is 2587 m and this is the highest peak in the region.

Global assessments on large mammal communities indicate that the Western Black Sea Region of Anatolia is one of the most important areas in the world [21]. The region has populations of large mammals, such as brown bear (*Ursus arctos*), red deer (*Cervus elaphus*), European roe deer (*Capreolus capreolus*), wild boar (*Sus scrofa*), grey wolf (*Canis lupus*) and wild cat (*Felis silvestris*) [22].

Camera-trapping

The systematic camera-trapping surveys were begun in August of 2014 and continued until November of 2018 at the Mount Ilgaz Wildlife Reserve, and 19 camera-trap stations were set up in a grid system with each station covering 2 × 2 km^2 (Figure 2). A passive digital camera-trap device was placed parallel to the ground at each station, and no bait or attractant was used. The coordinates (UTM) and altitude were recorded for the stations, and the camera-traps were set to be active for 24 hours in order to capture image records. The camera-trap stations were checked regularly to replace the batteries and memory cards.

Data evaluation

The camera-trap records were evaluated, and the species in the images were identified. If the image was not clear enough for identification, the record was classified as unidentified. The large mammal species in the study area were mostly identified at the species level. However, for martens on the camera-trap images, it was not always possible to make the identification at the species level since two marten species, stone marten (*Martes foina*) and pine marten (*Martes martes*), are found in the region. The colour and shape of the mark under the chin of these martens are the key morphological features that make identification at species level possible, and since the camera-trap images are usually unable to reveal these features, all the marten records were identified at genus level as *Martes* spp. For each

Table 1. The large mammal species detected at the Mount Ilgaz Wildlife Reserve by camera-trapping.

Family	Species	Common name	IUCN status*
Canidae	*Canis aureus*	Golden jackal	LC
Canidae	*Canis lupus*	Grey wolf	LC
Cervidae	*Capreolus capreolus*	European roe deer	LC
Cervidae	*Cervus elaphus*	Red deer	LC
Felidae	*Felis silvestris*	Wildcat	LC
Leporidae	*Lepus europaeus*	Brown hare	LC
Mustelidae	*Lutra lutra*	Eurasian otter	NT
Felidae	*Lynx lynx*	Eurasian lynx	LC
Mustelidae	*Martes* spp.	Marten	LC
Mustelidae	*Meles meles*	Eurasian badger	LC
Suidae	*Sus scrofa*	Wild boar	LC
Ursidae	*Ursus arctos*	Brown bear	LC
Canidae	*Vulpes vulpes*	Red fox	LC

*LC = Least concern; NT = Near Threatened

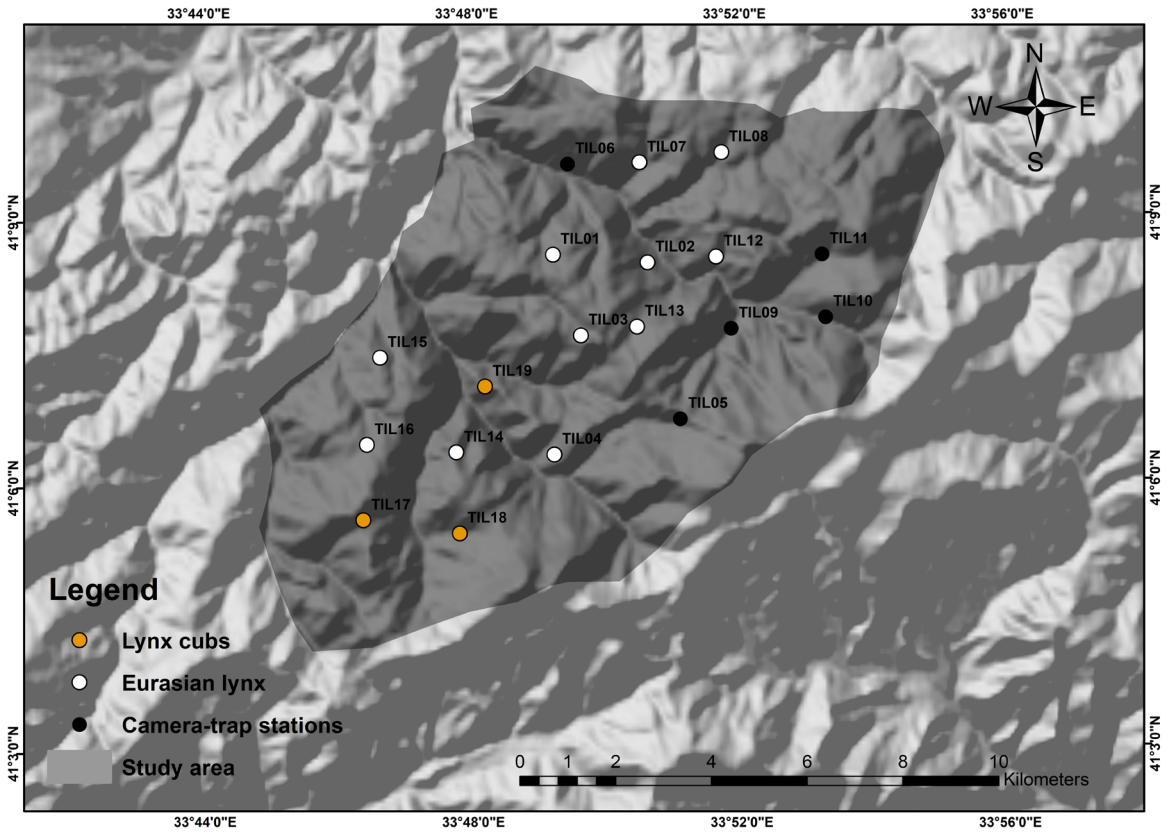

Figure 2. The dots indicate the camera-trap stations in the study area; white dots are the Eurasian lynx-positive stations and yellow ones are the stations where the Eurasian lynx cubs were detected.

identified record, information about the target species and the station were archived at the database together with the time, date, and coordinates.

A camera-trap station was designated as a positive station if a record of the target species was captured at the station at least once throughout the survey period. When any problematic situations were detected regarding the device during the control surveys, the station was considered inactive and the date of the last record it had captured was used to estimate the active camera-trap nights for the station. The total number of active camera-trap nights was calculated by the summation of the active days of the camera-traps.

RESULTS

The camera-trapping surveys were conducted continuously for over four years, and 20,823 camera-trap nights were achieved. As a result, 13 large mammal species, including the Eurasian lynx, were detected (Table 1).

Evaluating the camera-trap records, 468 images belonging to the Eurasian lynx were identified and the total number of positive stations for the Eurasian lynx was 14, which makes 73.7% of the total number of camera-trap stations in the study area (Figure 2). Eurasian lynx cubs were detected at three of these stations with six images in total (Table 2). The dates of the records belonging to the cubs were in August, September and October with the August images showing the youngest and smallest individual of lynx in the data set.

The three camera-trap stations, which are positive for the Eurasian lynx cubs, also captured young individuals of brown bear, grey wolf, red deer and brown hare (Table 2). Therefore, the stated sites are being used for breeding seasons by all three top predator mammal species present in the study area. The presence of young individuals of red deer and brown hare indicates that these sites are also suitable for the breeding of prey species. Moreover, one of these cub-positive camera-trap stations is the only one that has captured the young brown hares in the entire study area (Table 2).

Table 2. The positive camera-trap stations for the young individuals at the Mount Ilgaz Wildlife Reserve.

Camera-trap stations	Grey wolf	European roe deer	Red deer	Brown hare	Eurasian lynx	Wild boar	Brown bear	Total
TIL01								0
TIL02			+					1
TIL03	+						+	2
TIL04		+	+				+	3
TIL05								0
TIL06						+		1
TIL07								0
TIL08						+		1
TIL09		+						1
TIL10		+						1
TIL11		+						1
TIL12							+	1
TIL13		+	+				+	3
TIL14							+	1
TIL15								0
TIL16								0
TIL17	+				+			2
TIL18			+		+		+	3
TIL19			+	+	+		+	4

DISCUSSION

The breeding season is one of the most vulnerable periods in the life cycle of large mammal species. The limitations regarding movement and the needs of young individuals for food and protection make the breeding females prefer more undisturbed areas with food availability for this period [11,12,23]. It has been revealed that brown hares are one of the main preys of the Eurasian lynx in Anatolia [19,24]. Therefore, the detection of the young brown hares only at the cub-positive station (Table 2) emphasizes the importance of the site for the Eurasian lynx.

The low litter size and the high rate of juvenile mortality for the Eurasian lynx [7,8,25] indicate the importance of safe breeding sites to reduce the risk of an unsuccessful breeding season. Since the Eurasian lynx breeds once a year, trend of its population size is strongly dependent on the vitality of the new-born individuals. Consequently, the key factor for large mammal conservation involves the protection of breeding sites of the target species in order to increase the survival rate of the offspring.

The present study reveals that the central and southwestern parts of the study area (Figure 2) are being used by the juveniles of the Eurasian lynx, and moreover, the results also reveal the importance of these sites for the young individuals of other large carnivore and prey species in the study area (Table 2). Therefore, to ensure sustainable populations of the Eurasian lynx and other large mammals at the Mount Ilgaz Wildlife Reserve, these parts of the area should be assessed cautiously. Giving priority to the protection of these sites will contribute to develop more effective conservation plans for the wildlife populations at the Mount Ilgaz Wildlife Reserve.

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