CAMERA TRAPPING LARGE MAMMALS IN YENİCE FOREST HABITATS: A FEASIBILITY STUDY FOR CAMERA TRAPPING LARGE MAMMALS IN YENİCE FORESTS, TURKEY

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CAMERA TRAPPING LARGE MAMMALS IN FOREST HABITATS: A FEASIBILITY STUDY FOR CAMERA TRAPPING LARGE MAMMALS IN YENİCE FORESTS, TURKEY

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Özgün Emre CAN

ABSTRACT

CAMERA TRAPPING LARGE MAMMALS IN YENİCE FOREST HABITATS: A FEASIBILITY STUDY FOR CAMERA TRAPPING LARGE MAMMALS IN YENİCE FORESTS, TURKEY

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Widely applicable, quantitative field methods are needed to gather wildlife data for conservation and management initiatives in Turkey. In order to evaluate the use of camera traps in forest habitats of Turkey, we conducted a 5 phase camera trap survey by using 16 passive infrared-triggered cameras with a total sampling effort of 1200 camera trap days in Yaylacık Research Forest, a 50 km^2 forest patch of Yenice Forest in Karabük during January-May 2006.

The camera trap survey confirmed the presence of grey wolf (*Canis lupus)*, brown bear (*Ursus arctos)*, wildcat (*Felis silvestris)*, red fox (*Vulpes vulpes)*, badger (*Meles meles)*, pine marten (*Martes martes)*, roe deer (*Capreolus capreolus)* and wild boar (*Sus scrofa)* in the study area. The camera trap survey also revealed the presence of jackal (*Canis aureus)* and brown hare (*Lepus europaeus),* whose presence were not known by people living and working in the area. Contrary to the local belief, neither camera trapping survey nor ground survey confirmed the presence of lynx (*Lynx lynx)* in Yaylacık Research Forest.

The wolf was observed to be crepuscular and the wildcat showed a diurnal activity pattern. Wildcat seemed to avoid other carnivores spatially and temporally. Simulation studies suggested that camera trap surveys should last 14 days for wolf, 13 days for wildcat, 10 days for pine marten, and 11 days for roe deer, while it is advisable to conduct longer surveys, probably 15-20 days, for wild boar, red fox and brown bears.

The estimated population size for wildcat was 9 (SE=2.28227) with 95% confidence interval of 9 to 25 in the study area. A minimum of 6 brown bears were present in the study area.

Our study indicated that the local knowledge about the presence of wildlife should be considered by researchers, but it cannot replace scientific surveys conducted by field biologists.

This study was the first attempt to assess the presence, relative abundance, activity patterns and diversity of multiple mammal species by the use of camera trapping methodology in Turkey. The results suggest that camera trap surveys have the potential for gathering wildlife data at larger scales in Turkey, where information gap on large mammals is an obstacle for effective management and conservation of mammals.

Keywords

Camera trap, Yenice Forest, Yaylacık Research Forest, *Canis lupus*, *Ursus arctos*, *Felis silvestris*.

ÖZ

PASİF KIZILÖTESİ HAREKET ALGILAYICILI KAMERALAR YARDIMIYLA BÜYÜK MEMELİ TÜRLERİNİN YENİCE ORMANLARINDA İNCELENMESİ

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Türkiye'de yaban hayatının yönetimi ve korunması çalışmalarında kullanmak için gereken veriyi elde etmede geniş alanlarda kolaylıkla uygulanabilecek sayısal arazi methodlarına ihtiyaç vardır. Bu çalışma kapsamında Türkiye ormanlarında fotokapanların kullanımını test etmek için Ocak-Mayıs 2006 döneminde Yenice Ormanlarının 50 kilometre karelik bir bölümü olan Yaylacık Araştırma Ormanında 5 aşamalı bir fotokapan çalışması gerçekleştirildi ve 16 fotokapan kullanarak 1200 fotokapan günü gözlem gerçekleştirildi.

Fotokapan çalışması, çalışma bölgesinde kurt (*Canis lupus*), bozayı (*Ursus arctos*), yaban kedisi (*Felis silvestris*), tilki (*Vulpes vulpes*), porsuk (*Meles meles*), ağaç sansarı (*Vulpes vulpes*), karaca (*Capreolus capreolus*) ve yaban domuzu (*Sus scrofa*) olduğunu doğruladı. Fotokapan çalışması ayrıca varlığı bölgede yaşayan ve çalışan insanlar tarafından bilinmeyen çakal (*Canis aureus*) ve tavşanın (*Lepus europaeus*) bulunduğunu ortaya çıkardı. Yereldeki mevcut bilginin aksine vaşağın (*Lynx lynx*) bölgedeki varlığı fotokapan, iz ve işaret araştırmaları ile doğrulanmadı.

Çalışma bölgesinde kurtların gün batımından gün doğumuna kadar olan zamanda ve diğer etobur türlerinden makensal ve zamansal olarak uzak duran yaban kedisinin ise hem gececi hemde gündüz aktif olduğu gözlendi. Simülasyon çalışması kurt ile ilgili gerçekleştirlecek fotokapan çalışmalarının 14 gün, yaban kedisi için 13 gün, ağaç sansarı için 11 gün ve karaca için 11 gün olması gerektiğini gösterdi. Simülasyon çalışması aynı zamanda yaban domuzu, tilki ve bozayı ile ilgili gerçekleştirilecek fotokapan çalışmalarının ise 15-20 sürmesi gerektiğini ortaya koydu.

Çalışma bölgesindeki yaban kedisi populasyon büyüklüğünün 9 (standart hata=2.28227) birey olduğu hesaplandı. Tahminin %95 güven aralığı ile 9 ile 25 birey arasında olduğu hesaplandı. Çalışma bölgesinin en az 6 bozayı tarafından kullanıldığıda belirlendi. Çalışma, yaban hayatı konusunda yereldeki mevcut bilginin göz ardı edilmemesi gerekmesine rağmen, bunun hiç bir zaman uygun saha arştırmaların yerini dolduramayacağını ortaya koydu.

Türkiye'de fotokapan kullanarak memeli türlerinin varlığının, göreceli çokluğunun, aktivite desenlerinin, tür çeşitliliğinin ilk kez araştırıldığı bu çalışma; veri eksikliğinin etkin koruma çalışmaları için engel oluşturduğu Türkiye'de, ihtiyaç duyulan verilerin elde edilmesinde fotokapan metodolojisinin kullanılabilirliğini ortaya koydu.

Anahtar Kelimeler: Fotokapan, Yenice ormanları, Yaylacık Araştırma Ormanı,
Canis lupus, *Ursus arctos*, *Felis silvestris*.

.

To my parents, Azize and Vedat Can

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CHAPTER 1

INTRODUCTION

Turkey has many species of large mammals that are ecologically, economically and scientifically important. Large carnivore species present in Turkey include: wolf *Canis lupus*, brown bear *Ursus arctos*, striped hyena *Hyaena hyaena*, Eurasian lynx *Lynx lynx*, caracal *Caracal caracal,* wildcat *Felis silvestris;* large herbivore species include: red deer *Cervus elaphus*, roe deer *Capreolus capreolus*, goitered gazelle *Gazella subgutturosa*, chamois *Rupicapra rupicapra*, wild goat *Capra aegagrus*, mouflon *Ovis orientalis* and wild boar *Sus scrofa*. Turkey is a large peninsula located between Europe and Asia (Kryštufek and Vohralik, 2001). Therefore; European, Caucasian, Iranian and Arabian faunal elements have influenced and caused the uniqueness of the country in terms of large mammal diversity when compared to European countries. As a result Turkey hosts large mammal species like caracal, striped hyaena, goitered gazelle that are unique to Turkey in Europe.

The first information on the mammals of Turkey is found in the book of Usáma ibn Munkiz (1096-1188) and for the next seven centuries only incidental observations of travelers are available (Kryštufek and Vohralik, 2001). However, the scientific data collection activities started in 18^{th} century and K. E. Abbott and C. G. Danford travelled in different regions of Turkey and collected specimens between 1833 and 1879 (Kryštufek and Vohralik, 2001).

According to Kryštufek and Vohralik (2001), A. Wahby (Vehbi) is probably the first Turkish scientist that reported on the biology of a large mammal of Turkey; the wild goat, in 1931. In the post World War II period, German ornithologist H. Kumerloeve studied mainly birds in Turkey but he also collected information on large mammals during his field trips (Kryštufek and Vohralik, 2001). The work of Kumerloeve (1966) presents the distributions of large mammals in the form of point locations and it is probably the most reliable study presenting information on the distribution of large mammals in Turkey. Later, S. Huş and N. Turan contributed to information on large mammals of Turkey during 1960s and 1980s.

The tentative large mammal distribution maps presented by Turan (1984) are important to notify since they seem to synthesize the previous information and his own observations on the large mammals of Turkey. It is important to note that all those previous historical works provided mainly distributional information about the large mammal species in Turkey. Although research on mammal fauna has increased during the last 20 years, according to Kurtonur (1996), the research on large mammals is still very limited in Turkey.

As we are aware of the studies of Kaya on wild sheep (Kurtonur, 1996); Oğurlu (1997) on red deer; Başkaya (2000) on chamois, Can (2000) on wolf, and Can and Togan (2004) on brown bear are pioneer field studies with specific focus on large mammal species (Council of Europe, 2006).

1.1. Necessity of Research on Large Mammals

Today, Turkey is a party to the Convention on Biological Diversity and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) which are also relevant to large mammal conservation. Turkey has numerous laws, regulations, strategies and programs favoring conservation but the implementation process require increased commitment and vigilance (Kaya and Raynal, 2001).

Today, illegal and excessive hunting is one of the most important threats to large mammal species of wolf, brown bear, Eurasian lynx and wild goat (National Report on Sustainable Development, 2002) in Turkey. According to National Strategy and Action Plan for Biodiversity in Turkey (2001), red deer, roe deer, fallow deer, wild sheep and goitered gazelle populations are also decreasing in Turkey. This statement is probably true for other large mammals as well.

In fact, the National Strategy and Action Plan for Biodiversity in Turkey (2001) states that "Our natural resources and biodiversity are in the unfortunate course of deterioration, then decrease and finally disappearance". It is evident that when the large herbivore populations, the main prey base for carnivores, are in such unfavorable condition and declining in Turkey, we cannot expect to find stable carnivore populations.

Wildlife conservation is a specific branch of conservation biology and deals with the protection and analysis of wildlife ideally by appreciating that evolution is the basis for understanding all biology topics, ecological systems are dynamic and nonequilibrial and human kind is a part of the natural world (Meffe and Carroll, 1994).

Wildlife management is on the other hand as stated by Aldo Leopold is "the art of making land produce sustained annual crops of wild game for recreational use" (Wagner, 1989). In other words, wildlife management is the whole process of keeping wildlife populations at certain limits that are acceptable by the wildlife agencies and public. Effective wildlife conservation and management requires reliable and long term data so that relevant conservation and management actions can be planned, implemented and then the impact of those decisions can be monitored and assessed.

In Turkey, the lack of reliable data on large mammal populations is an obstacle for implementing effective conservation and management initiatives since in the absence of reliable data, specific actions involving species and habitats cannot be considered and management decisions cannot be made. This applies to not only wildlife management but also to forestry as well. Regular field surveys and monitoring programs are practically non-existent for most of the large mammals and especially carnivores in Turkey.

Having realized the scarcity of the studies, the national wildlife authority initiated a kind of a monitoring program for wild goat in 2001 but due to lack of experienced and qualified staff, this effort resulted in being a simple inventory (National Report on Sustainable Development, 2002).

Another issue that needs to be tackled is the scarcity of technical staff and specialists in nature conservation programs in Turkey (National Report on Sustainable Development, 2002). This problem is even more significant when it comes to wildlife conservation and management.

It is evident that there is an urgent need to increase the efforts on wildlife management and conservation in Turkey and this implies that there is a need for establishing effective techniques for gathering data to assess large mammal populations in Turkey.

1.2. Technical Difficulties in Relation to Large Mammal Studies

However, studying large mammal populations is not easy due to several reasons. Most mammals occur at low densities, are secretive and difficult to observe (Sutherland, 2000). Carnivores are generally very hard to observe as they are often nocturnal or live in dense habitats, meaning that many survey methods may not detect their presence (Linnell *et al.,* 1998). Their reproductive rates are generally low; social structure range from spatially solitary individuals with only brief encounters during breeding or form groups or packs, and size of the home ranges might be large (Gittleman *et al.,* 2001). In some cases, it may be impossible to produce estimates, in other cases accurate methods exist, but they require more fieldwork, high costs and comprehensive methods like radio-collaring animals (Linnell *et al.,* 1998). In any survey, most sample units will not hold any individuals, or signs of an individual, at the survey time (Linnell *et al.,* 1998). There will be many zero values and low absolute values, factors that cause large variances in any statistical analysis (Linnell *et al.,* 1998). Shortly, carnivores are also probably the most expensive and difficult group of animals to conserve (Linnell *et al.,* 1998). Estimating the density, population trend monitoring of large carnivores is not easy; it must be one of the most difficult tasks for a wildlife biologist or manager (Linnell *et al.,* 1998). Because of these problems diverse methods have been developed to estimate their population size, to monitor their distribution, and unlike other groups there are no globally recognized standard methods (Linnell *et al.,* 1998).

As precisely stated in the National Report on Sustainable Development (2002), Turkey is a one of the many countries in the world where human resources, relevant expertise and historical data on wildlife are limited. Therefore for Turkey and for many other countries there is a need for quantitative, low labor cost, non-invasive and that cause minimal environmental damage methods that can be widely applicable to collect data in order to fill the information gap.

Tracking animals by following footprints in dust, mud, sand or snow is probably the oldest known method of identifying mammal's presence in an area and counts of dung, nests, trails, calls and direct observation along line transects are widely used for abundance and richness estimates (Silveria *et al.,* 2003). While line transects can be used to survey the density of relatively abundant mammal species, they often fail to record cryptic and rare species (Tobler *et al.,* 2008).

1.3. Camera Trapping Technique: A New Promising Research Tool

A relatively new methodology which involves the use of specially designed cameras called camera traps (Figure 1) are nowadays found to be most appropriate for mammal inventory in all environmental conditions (Silveira *et al.,* 2003) and using camera traps have become popular among the researchers and potential applications of the camera trap technique are increasing (Silveria *et al.,* 2003; Yasuda, 2004; Tobler *et al.*, 2008). Over the past decade, the rapid expansion in camera trap use is reflected in a 50% annual growth in the number of published papers that either directly address camera trapping methods or use them as a research tool (Rowcliffe and Carbone, 2008).

Camera trapping technique uses specially designed automated camera devices with infra-red sensors. Once the camera trap units are precisely placed in the predetermined locations of a given study area, they take pictures of the animal passing by the camera traps. Camera trapping technique is a quantitative, low labor cost, non-invasive technique that may cause minimal environmental disturbance and it is robust to variation in climate and ground conditions and can be used to collect information on elusive species and in difficult terrains where other field methods are likely to fail (Rowcliffe *et al.,* 2008). Camera traps can be set to photograph animals passing by the unit during day, or night or continuously over 24 hours a day. The equipment used in camera trapping technique can be in variety of forms ranging from homemade pressure-pad devices to expensive, sophisticated commercial units (Thompson, 2004).

Figure 1. A camera trap unit fixed at a tree. Extra camouflage was achieved by placing moss on the unit (Photograph by Ö. E. Can).

The sampling process in camera trapping technique consists of deploying a number of camera trap units in the study area to obtain photographs of the target species (Thompson, 2004). The researcher usually makes periodic revisits and checks the camera trap units to ensure their proper functioning and to replenish film and batteries in the units (Thompson, 2004). After processing the films taken from the camera trap units in the field, each picture on the film is now a camera trap record (Figure 2).

The rapid expansion of camera trap surveys for cryptic species has led to the widespread application of this technique, often with little standardization across studies (Kelly, 2008). For example, the amount of effort, which is called as the total number camera trap nights or camera trap days spent in a camera trap study were: 128 camera trap days (Jeganathan *et al.,* 2002); 441 camera trap days (Wegge *et al.,* 2004); 540 camera trap days (Trolle and Kèry, 2003); 914 camera trap days (Karanth *et al.,* 2004). Even focusing on the same species, the camera trap days vary widely from 450 trap nights to 2280 camera trap nights (Kelly, 2008). Similarly number of camera trap units used in a camera trapping survey also varies from 5 to 31. Yasuda (2004) used 5 camera traps, Trolle and Kèry (2003) used 6 camera traps, (Jeganathan *et al.,* 2002) used 8 camera traps, Srbek-Araujo and Chiarello (2005) used 9 camera traps, Wegge *et al.* (2004) used 6-9 camera traps, Holden *et al.* (2003) used 5-19 camera traps and Maffei *et al.* (2005) used 16-31 camera traps in their camera trapping studies.

Figure 2. A representative selection of camera trap photographs i.e. camera trap records (Photograph Ö. E. Can).

Although there is a consensus among researchers on placing the camera traps in sites in a way to maximize the data collection, limited attempts at methodological standardization of camera trapping methodology have been made so far (Yasuda, 2004) and there is an ongoing debate concerning proper camera trapping protocol. However, with the current trend in studies that involve camera trapping technique, it will not probably take much time to standardize the camera trapping technique specific to species and habitats. Majority of the published camera trapping papers is restricted to a single species with individually unique natural markings and most camera trap studies focused on striped or spotted felids and species without individual markings have been underrepresented in recent camera trapping research (Rowcliffe *et al.,* 2008).

As a summary, camera trapping technique is a useful tool in wildlife research and conservation for the following research purposes (Silveira *et al.,* 2003):

1. To document the presence of focal species in a given area, for mammal inventories and for presence/absence surveys in monitoring programs, metapopulation studies and habitat modeling (Holden *et al.,* 2003; Thompson, 2004; MacKenzie, 2005; Srbek-Araujo and Chiarello, 2005; Tobler *et al.,* 2008),

2. To find out the diversity and activity patterns of mammal species (Silveria et al., 2003; Yasuda, 2004, Maffei *et al.*, 2005; Azlan and Sharma, 2006; Bietti *et al.,* 2006; Trolle *et al.,* 2007; Tobler *et al.,* 2008),

3. To estimate population sizes and densities of target mammal species after identification of individual animals (Karanth, 1995; Trolle and Kèry, 2003; Dillon and Kelly, 2007; Karanth *et al.,* 2004; Thompson, 2004; Maffei *et al.,* 2005; Trolle and Kerry, 2005; Larrucea *et al.,* 2007; Rowcliffe *et al.,* 2008; Simcharoen *et al.,* 2007; Tobler *et al.,* 2008),

4. To monitor a single species at multiple sites or to monitor multiple species at a single site and to assess and quantify community structure and changes in community structure for low cost biodiversity modeling (MacKenzie, 2005).

1.4. Present Study in Brief

The study was conducted in Yaylacık Research Forest, a 50 km^2 forest patch of Yenice Forest (41°05´N 32°18 E´) located south of Karabük, in north-western Turkey. Yenice Forest is one of the largest intact forest habitats in Turkey and it was identified as one of the hundred European forest hotspots that deserves urgent protection by World Wildlife Fund (WWF) (Lise, 2005). A global review of large mammal faunas (Morrison *et al.,* 2007) has recently identified Yenice Forest as one of the intact large mammal fauna regions in the world.

This study is the first attempt in surveying large mammals by the use of camera traps in Turkey. The objectives of our study were;

1. To establish the use of camera trap surveys in the forest habitats that form the largest portion of large mammal habitat in Turkey,
2. To document the presence of the following 7 target mammal species: Wolf, brown bear, wildcat, red fox, pine marten, roe deer and wild boar in Yaylacık Research Forest within Yenice Forest in Karabük,
3. To calculate diversity indices and to use them for evaluation of survey regions within Yaylacık Research Forest,
4. To reveal the activity patterns of 7 target species with respect to time and space,
5. To evaluate the efficiency of camera trapping technique for 7 target species,
6. To attempt to identify the individuals of some species (such as brown bear and wildcat) living in the study area,
7. To reveal the population size of wildcat in the study area,
8. To provide baseline data to facilitate future research in the study area.

CHAPTER 2

MATERIALS and METHODS

2.1. Study Area

The study was conducted in Yaylacık Research Forest, a 50 km^2 forest patch of Yenice Forest (41°05´N 32°18 E´) located south of Karabük, in north-western Turkey (Figure 3). Yenice Forest is one of the largest intact forest habitats in Turkey and covers an area of about 750 km^2 (Figure 4). It was identified as one of the hundred European forest hotspots that deserve urgent protection by World Wildlife Fund (WWF) (Lise, 2005). A global review of large mammal faunas has recently identified Yenice Forest as one of the intact large mammal fauna regions in the world (Morrison *et al.,* 2007). The altitude of Yenice Forest ranges from 100 m to 2000 m and the region receives an average of 1200 mm annual rainfall. The average temperature of the region is 8.8ºC with average summer and winter temperatures of 30ºC and 1ºC respectively. Most of the rainfall occurs during spring and the average number of snowy days is 25. The tree species found in Yenice Forest are beech (*Fagus orientalis*), European hornbeam (*Carpinus betulus*), Turkey oak (*Quercus cerris*), Istıranca oak (*Q. hartwissiana*), oak wood (*Q. petraea*), balkan maple (*Acer hyrcanum*), Norway maple (*A. platanoides*), common ash (*Fraxinus excelsior*), yew (*Taxus baccata*), Caucasian fir (*Abies nordmanniana*) and Scots pine (*Pinus sylvestris*). Fagus orientalis dominates the forest at the 1000 m to 1200 m altitude range. The Çit Dere vicinity, is dominated by Istıranca oak and Kapaklı vicinity is dominated by yew and Turkish filbert (*Corylus columa*).

At altitudes higher than 1200 m, Caucasian fir and Scots pine becomes the dominant species. In southern part of Yenice Forest, due to the effect of the Black Sea, sandal tree (*Arbutus andrachne*), (*Cistus salviifolius*), tree heath (*Erica arborea*), prickly juniper (*Juniperus oxycedrus*), terebinth (*Pistacia terebinthus*) is distributed.

In Yenice Forest, there is a small wildlife protection site and two small nature conservation areas: Kavaklı nature conservation site of about 4 km^2 and Çit Dere nature conservation site of about 8 km^2 (Lise, 2005). The Yenice Forest is closed to human settlements and as opposed to other areas in Turkey; there are no villages in the forest. The Yenice sub-province and few villages are located near the Yenice Forest. Yaylacık Research Forest is a protected forest patch where only forestry service personal can enter using controlled gates. As a result, human presence is very low.

We identified Yaylacık Research Forest as the study area by consulting the national forestry and wildlife authorities and by considering logistical and practical reasons such as the risk of theft and vandalism of the camera traps.

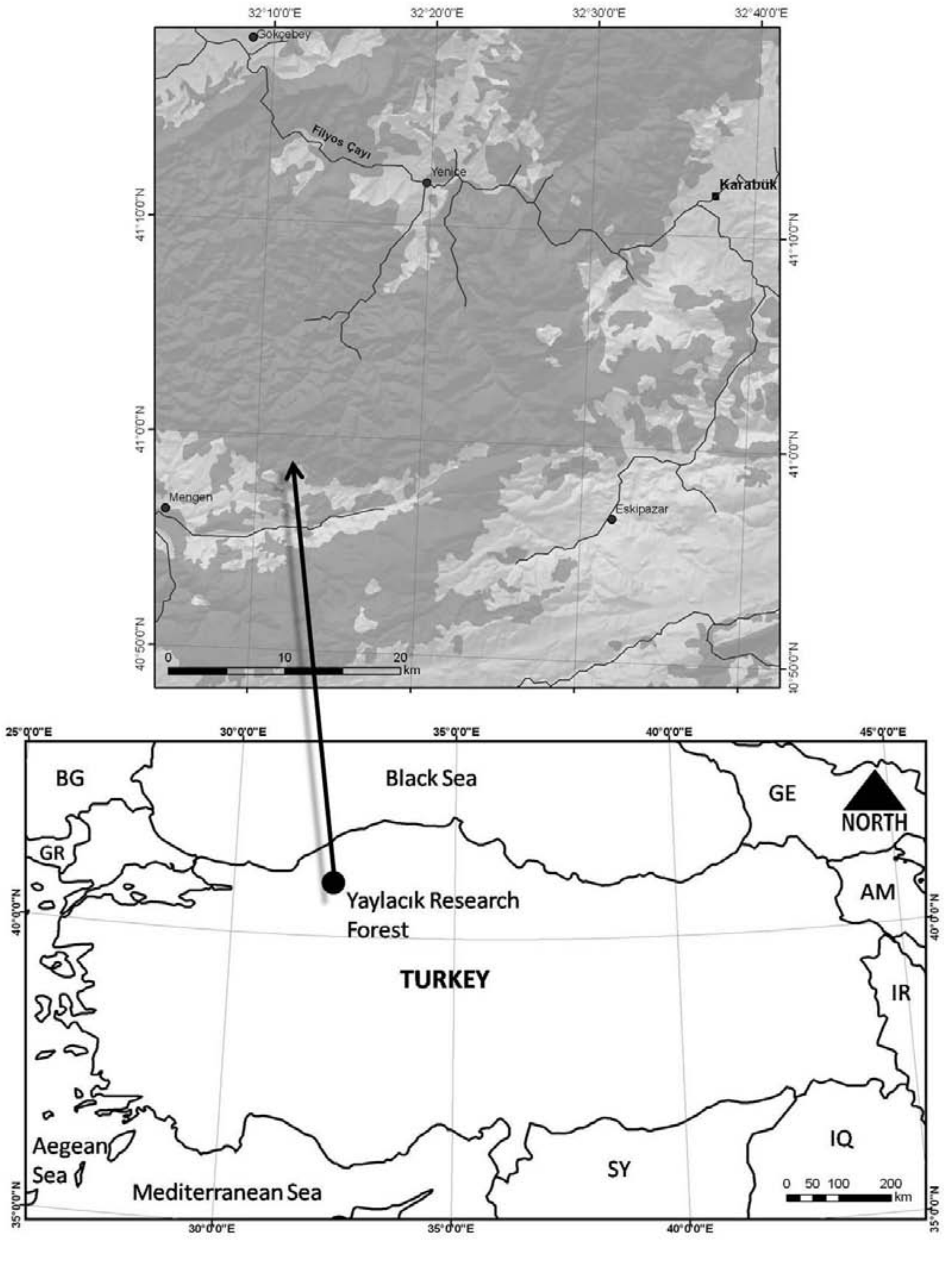

Figure 3. The location of Yaylacık Research Forest in Turkey (the black dot on the below map) and in relation to Karabük (above map).

Figure 4. A general view of Yenice Forest (Photograph by Aykut İnce).

2.2. The Theory and Practice of the Camera Trap Survey

We conducted a 5 phase camera trap survey between January 2006 and May 2006 using a combination of 12 CamTrakker (CamTrakker, Georgia, USA) and 4 DeerCam (DeerCam, Pak Falls, USA) passive infrared camera trap units. We divided the 50 km^2 study area into 50 cells that are 1 km^2 each using the Yaylacık Research Forest map of 1/50.000 scale provided by the Central Anatolia Forestry Research Institute of Turkish Ministry of Forestry (Wegge *et al.*, 2004) (Figure 5 and Figure 6).

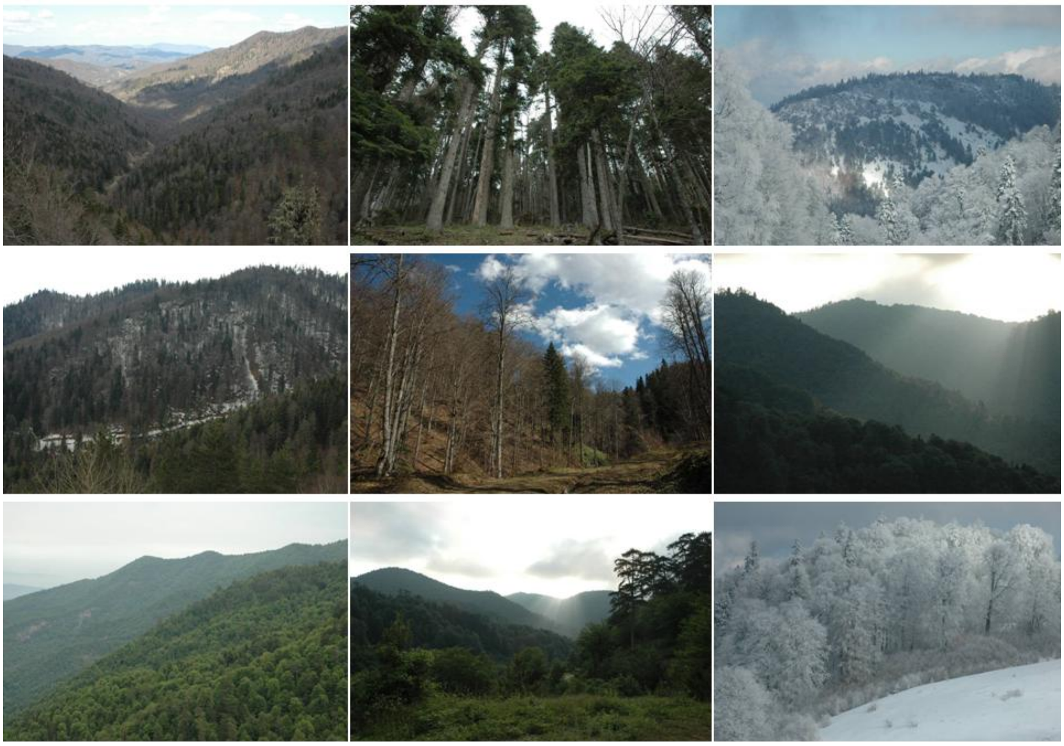

Figure 5. Representative views from the 9 of the study cells in Yaylacık Research Forest (Photographs by Ö. E. Can).

In each of the 5 consecutive camera trap surveys, the camera traps were placed in 8 cells covering an area of 8 km^2. In each study cell, we set 2 camera traps for a period of 15 days (Karanth and Nichols, 2002; Karanth *et al.,* 2004). Since this present study is targeting several mammal species, thus it is a multi species camera trap study, the smallest home range (red fox) among the species was taken into consideration and size of a study cell was determined as 1 km^2. The sampling procedure was repeated for the second, third, forth and the fifth camera trap surveys as described by Karanth *et al.* (2004). We sampled 80% (40 km^2 of 50 km^2) of the study area with a total of 1200 camera trap days of observation (Figure 7).

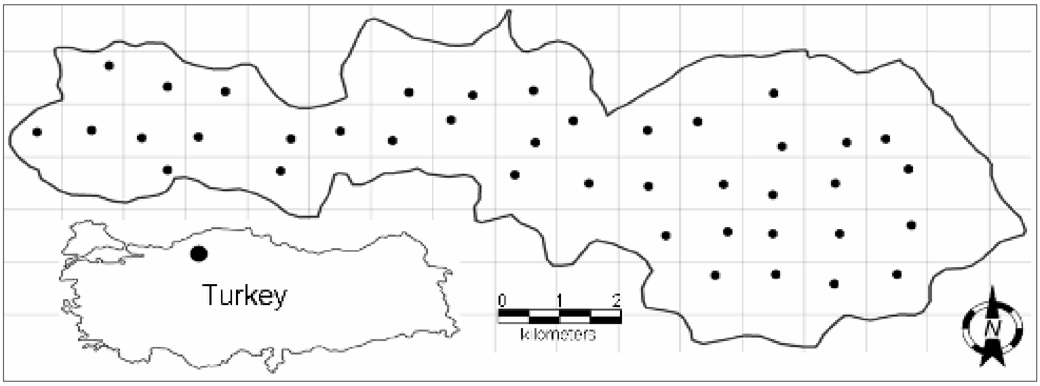

Figure 6. The Yaylacık Research Forest camera trapping survey area in Yenice Forest in Turkey. The black dot shows the location of the study region in Turkey (lower map). The dots show the relative locations of the camera traps in the study area. The scale is as it was on the study region map.

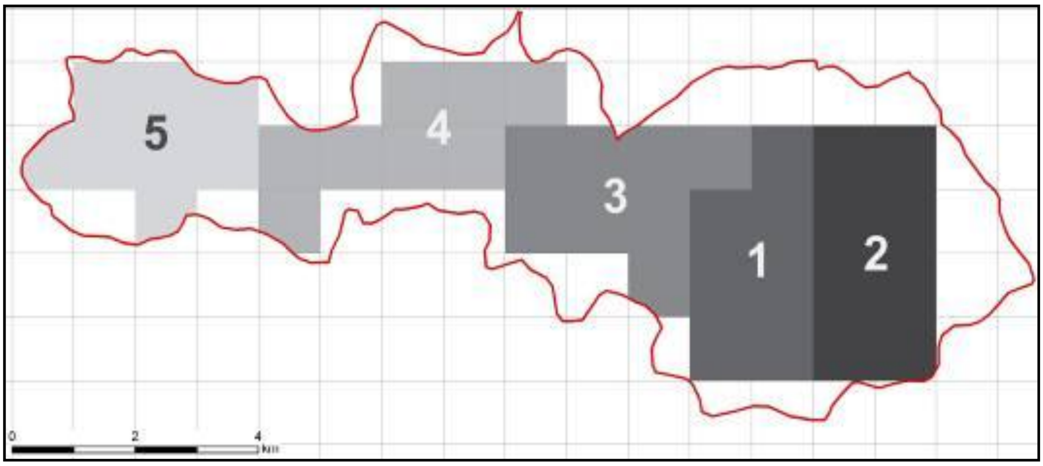

Figure 7. The 5 camera trap survey regions of Yaylacık Research Forest.

The camera traps were installed by the use of global positioning system (GPS) in the field in a way that the distance between the camera traps were based on the smallest red fox home range. The distance between the camera traps were in the range of 1-1.5 kilometers in order to fill all the potential home ranges of red foxes in accordance with Karanth and Nichols (2002), Silveira *et al.* (2003), Kawanishi and Sunquist (2004), Silver (2004), Dillon and Kelly (2007) and

Simcharoen *et al.,* (2007). The camera traps were placed in each study cell in a way to maximize the number of photographs taken as similarly done in previous studies (Silver, 2004; Karanth *et al.*, 2004; Wegge *et al.*, 2004; Jàcomo *et al.*, 2004; Maffei *et al.*, 2004; Wallace *et al.*, 2003; Holden *et al.*, 2003; Karanth and Nichols, 2002). The camera traps were placed about 30-50 cm above the ground depending on the terrain (Figure 8). Locations of the camera traps were recorded by GPS (Garmin e Trek Vista C, Garmin USA). Camera traps were set to run continuously with a 3 minute delay between photos over 24 hour period and print film with ASA 200 and 400 with 36 exposures were used. Each camera trap was locked to a tree with padlocks to prevent theft during the study period.

After setting each camera trap in the field, a test picture was taken to test whether the camera trap worked properly and to register the camera trap location, date and time the camera trap was placed in the field. Each camera trap was visited at the end of each 15 day period, and all film and batteries were replaced with fresh ones. All films developed and printed were catalogued and negatives were archived.

Interviews were made with forestry service personnel (n=5) that have been working in the study area for five to fifteen years and with locals (n=15) that have been working in the forest logging activities for more than 5 years in order gather information on the presence of mammals in the study area.

Figure 8. Representative photographs of camera traps in Yaylacık Research Forest (Photographs by Ö. E. Can).

We used four wheel drive field vehicles (Ford Ranger 4x4 XLT pick-up, Chrysler Desoto Fargo 4x4 pick-up, Massey Ferguson 3.075D 4x4 tractor) to travel to the study area. The forest roads were usually closed during autumn and winter times due to fallen trees and heavy snow wall therefore access by field personnel within the study area was mainly by foot (Figure 9). Standard forms were used for collecting and organizing camera trap data during the study (Appendix A).

Figure 9. Representative photographs showing various stages of the field work. The top three photographs show the ground trekking stage and the rest six photographs show the means of transportation in the field and setting a camera trap (Photographs by Ö.E. Can).

Wolf, brown bear, wildcat, red fox, marten, wild boar and roe deer were identified as the target species of present study. Therefore camera trapping data for the 7 target species were considered for analysis. All camera trap records were filtered to select the suitable camera data for the analysis using the following process: First, unknown camera trap records (photographs with no registered animal) and camera trap records of non-target species were filtered out. Second, camera trap records that belong to the target species were filtered to avoid any duplicates in the data by considering the station number, date and time of each camera trap record. By doing so, the camera trap records taken by a given camera trap station in the same day within close time intervals (up to 5 minutes) were considered as single record.

2.3. Mammal Diversity

Camera trapping data was used to calculate the Shannon's, Brillouin's and Simpson's diversity indices to compare the mammal diversity of the 5 camera trap survey regions of Yaylacık Research Forest. Shannon's diversity index (Krebs, 1999) can be calculated as:

$$H' = \sum_{i=1}^{s} (p_i)(log_2 p_i)$$

Where

$\mathbf{H}$ =Index of species diversity

S= Number of species

p_i = Proportion of total sample belonging to *i*th species

Brillouin's diversity index (Krebs, 1999) can be calculated as:

$$\hat{H} = \frac{1}{N} log \left(\frac{N!}{n_1! \, n_2! \, n_3 \, ...} \right)$$

Where

$\hat{H}$ = Brillouin's index

N=Total number of individuals in entire collection

n_1 = Number of individuals belonging to species 1

n_2 =Number of individuals belonging to species 2

Simpson's diversity index (Krebs, 1999) can be calculated as;

$$1 - \hat{D} = 1 - \sum_{i=1}^{s} \left[\frac{n_i \, (n_i - 1)}{N \, (N - 1)} \right]$$

Where

(1-D)= Simpson's index

$n_{i\,=}$ Number of individuals of species *i* in the sample

N=Total number of individuals in the sample

s= Number of species in the sample

Shannon's, Brillouin's and Simpson's diversity indices were calculated by using the BIO-DAP software which is a biodiversity analysis package (Thomas, 2000). A multidimensional scaling (MDS) analysis based on an R matrix (Harpending and Jenkins, 1973) was performed using SPSS (version 13.0, SPSS, Inc., Chicago, IL) statistical package. Multidimensional scaling of the 5 camera trap survey regions was done using the presence/absence values of the target species for the 5 survey regions. The relationship between the presence/absence of species to location was visualized with the multi dimentional scaling (MDS) module of NTSYS-pc (Rohlf, 2000).

2.4. Activity Patterns of 7 Target Species

In order to reveal the activity patterns of target species, we assumed that the numbers of photographs taken were correlated with mammal activity levels (Azlan and Sharma, 2006; Bitetti *et al.*, 2006; Dillon and Kelly, 2007). Time periods were pooled in 6 hour intervals and activity level of a species was measured by the percentage of the total qualified photographs (Azlan and Sharma, 2006; Bitetti *et al.*, 2006; Dillon and Kelly, 2007). In order to understand the activity patterns of 7 target species at the spatial scale, all camera trap records given in Appendix A were categorized according to the camera trap locations that they originate from. This information was presented in the form of 20 maps with the score of the each study cells. The score for a given study cell was simply equal to the number of camera trap records that belong to that particular study cell.

2.5. Encounters and Simulations in relation to Camera Trapping Efforts

The encounter rate (mean number of camera trap record gathered from the study area per 100 camera trap days) for each of the 7 target species were calculated by dividing the total number of camera trap records for each species by 1200 camera trap days and then by multiplying with 100 days.

A computer simulation was made to understand the relation between the length of camera trap surveys with the number of camera trap records gathered for each target species. A computer program was written in C programming language to pool from all camera trap records collected according to simulated number of days from 7 to 15 days. The program was asked to make 1000 iterations for each of the simulated 7 to 15 day camera trap surveys.

2.6 Encounter Rates and Camera Trap Locations

The location of the camera traps were categorized in three classes as camera traps on forest roads, camera traps on trails and camera traps in valley-sides, slopes, ridges, passes and crests were all classified as traps on other locations. Furthermore, χ^2 goodness of fit test (Daniel, 1999) was performed to determine if the encounter rate of 7 target species were equal on forest roads, trails and on other types of locations.

2.7. Track Surveys

Ground surveys were conducted by 3 experienced trackers including the author while setting the camera traps in each study cell. During the ground survey, field signs such as tracks and signs of all mammal species has been searched in each study cell and when found, they were photographed, GPS locations were recorded relevant field form was filled. Similarly, the ground survey was repeated to document the mammal species present at the end of each camera trap session, after the end 15 days of camera trapping in that particular study cell. Later the results from the ground survey and camera trap survey in that particular study cell were comparatively evaluated.

2.8. Identification of Individual Brown Bears and Wildcats in the Study Area

The brown bear records were examined by considering the body confirmation: body size and general appearance, shape and size of the head, and length of the legs.

The presence of any marks such as wounds on each animal in the records was also checked to aid the individual identification. Similarly, different individuals of wildcats were identified by checking the general physical appearance and the unique tail patterns of the each individual.

2. 9. Estimating the Population Size of Wildcats

For estimating the wildcat population size, program MARK (White and Burnham, 1999) was used. MARK was employed to test the "close population" assumption, to test the fit of the data to different estimators and to compare the models using the program's selection procedure. Four main population size estimators are available in MARK. The null model (M_0) assumes that the time of capture, heterogeneity among individuals, or behavior do not affect capture probabilities of the animals in the population. M_h model assumes that the capture probabilities are heterogeneous for each individual wildcat and this is not affected by trap response or time. M_b model assumes that capture probabilities are affected by trap-response behavior but are not influenced by heterogeneity or time. M_t model assumes that capture probability is same for all individual wildcats but varies due to time-specific factors. There are four other complex models such as M_{bh}, M_{th}, M_{tb} and M_{tbh} which incorporates the effects of heterogeneity, trap response and time in various combinations. The model selection function of program MARK scores the models between 0.0-1.0, and a higher score indicates a better fit of the model to the capture history data collected during the camera trap survey. We used the model selection algorithm provided in the program and reported estimate from the program of population size and the standard error of population size based on the most adequate model.

CHAPTER 3

RESULTS

Camera trap surveys produced sets of photographs and these photographic records (camera trap record) established the main data base for the study. A camera trap record gathered from a camera trap station (camera trap unit) provided the information about the species registered in the photograph, date and hour of photograph taken. A typical camera trap record of a wolf is presented in Figure 10. Example of camera trap records for seven target species are presented in Appendix B.

Figure 10. A typical camera trap record documenting a wolf together with the date (29) and hour information (18.00) during which the camera trap photograph was taken.

3.1. Summary of Camera Trap Surveys in Yaylacık Research Forest

The 5 consecutive camera trap surveys documented the presence of wolf, brown bear, jackal, wildcat, red fox, badger, pine marten, wild boar, roe deer, and brown hare, in Yaylacık Research Forest (Figure 11).

Figure 11. Representative camera trap records for wolf (A), brown bear (B), wildcat (C), red fox (D), badger (E), pine marten (F), jackal (G), wild boar (H), roe deer (I) and brown hare (J) from Yaylacık Research Forest.

Squirrel, porcupine, mice and birds were also documented during the camera trap surveys. This study, however, focuses on the following 7 target species: Wolf, brown bear, wildcat, red fox, pine marten, wild boar and roe deer. Therefore camera trapping data only for those 7 target species were considered for the analysis.

3.1.1. Absolute Observed Frequencies

During the study, a total of 402 camera trap records were collected in the 5 consecutive camera trap surveys. The maximum number of camera trap records was for wild boar with 174 records. There were 63 camera trap records that were impossible to identify (unknown records) since the animals passing by the camera traps were not registered in the photographs. The breakdown of the camera trap records according to species is presented in Figure 12.

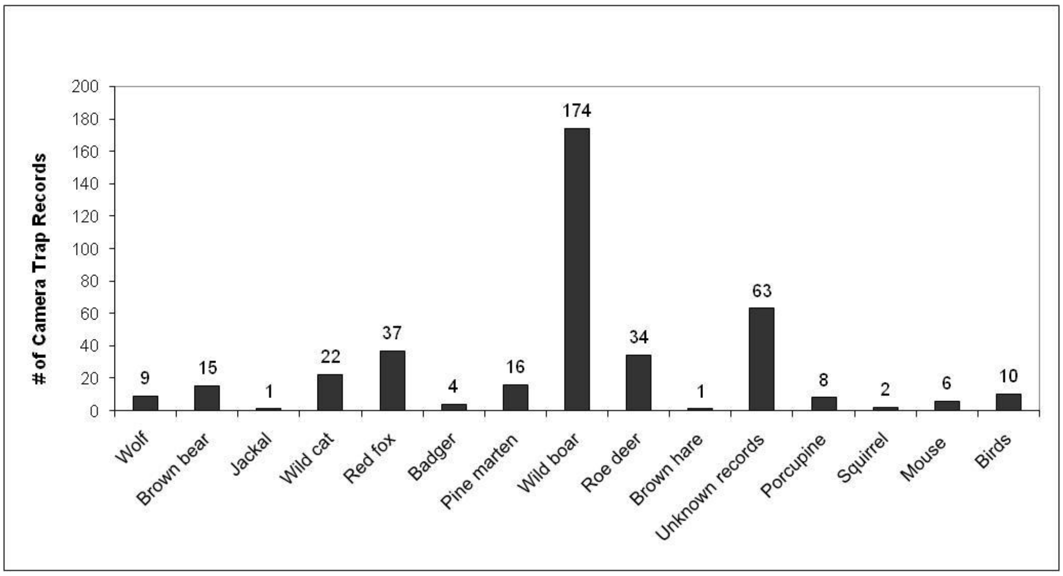

Figure 12. The number of camera trap records gathered from Yaylacik Research Forest.

A total of 15.7% of the camera trap records (63 out of 402) were unknown and 7.8% of the camera trap records (32 out of 402) were for non-target species. 76.5% of the camera trap records were suitable for the analysis. All camera trap records were filtered to select the suitable camera trap records that will be used for the analysis using the following process (Figure 13). First, unknown camera trap, camera trap records of non-target species (jackal, badger, brown hare, porcupine, squirrel, mouse and birds) were filtered out. Second, camera trap records that belonged to the 7 target species were filtered to avoid any duplicates in the data by considering the station number, date, and time of each camera trap record. Camera trap records taken by a given camera trap station in the same day within close time intervals (1 to 5 minutes) were considered as a single record. After filtering the camera trap records for 7 target species, the number of usable records was reduced from 307 records to 271 records (-11.7%). Suitability of camera trap records for analysis differed among the 7 target species in Yaylacık Research Forest (Figure 14).

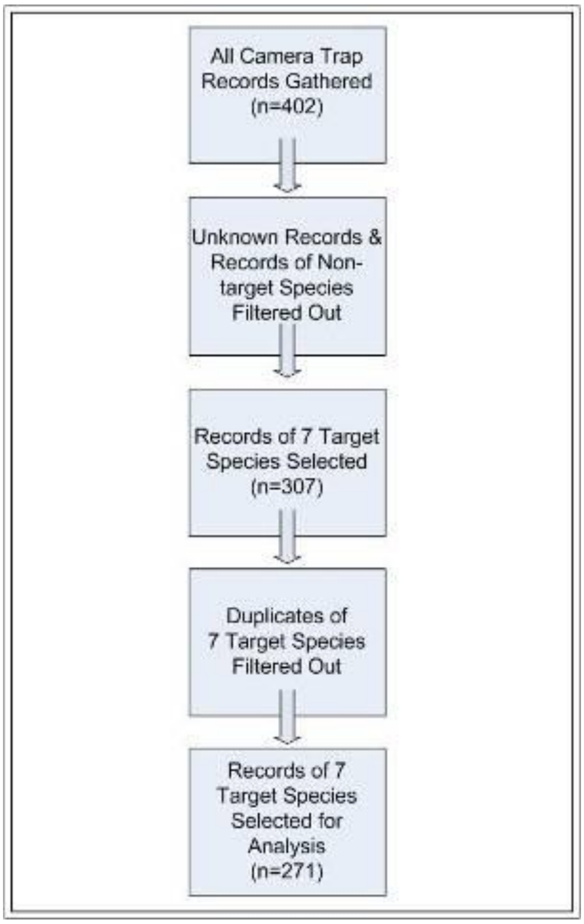

Figure 13. Filtering steps applied to camera trapping data in the study.

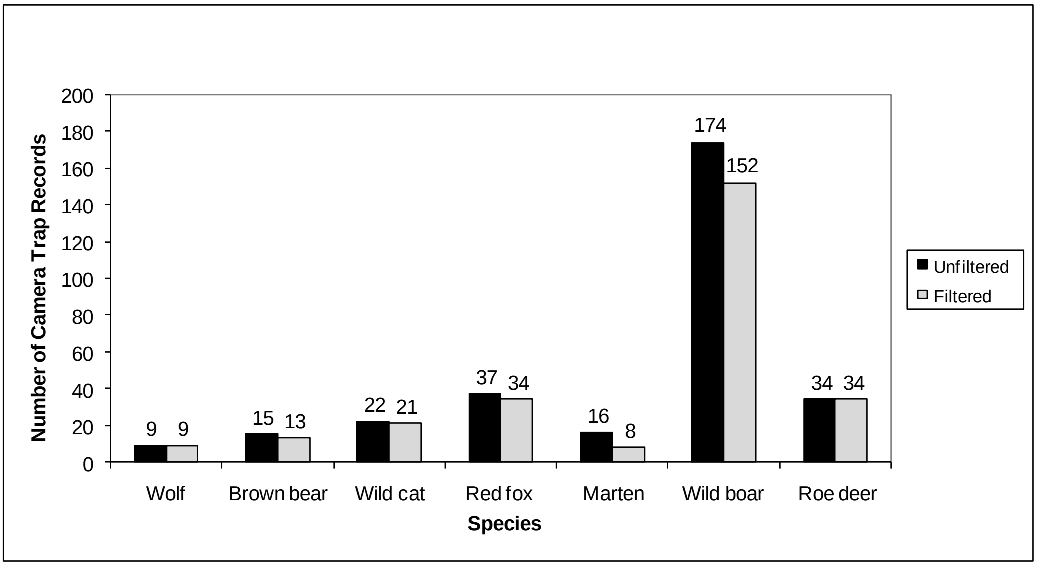

Figure 14. Comparison of unfiltered and filtered photographic results according to species.

A total of 61 records were incomplete because only a part of the animal was in the photograph. Incomplete camera trap records contained detail showing the tail or back of the animal, but did not provide proper information for the identification of the individuals. However, they were good enough to identify the species (Figure 15). 80% of the wolf camera trap records (4 out of 9 records), 44.4% of the brown bear camera trap records (4 out of 13 records), 34.5% of the wild boar records (39 out of 152 records) were incomplete (Figure 16). The only species that did not have incomplete record was pine marten. 25.9% of the red fox records (7 out of 34 records) and 23% of the wildcat records (4 out of 21 records) were incomplete. After marten, the roe deer had the most complete records with an incomplete photo ratio of only 9.6% (3 out of 34).

Figure 15. Representative incomplete camera trap records for wildcat (A), wolf (B), roe deer (C), wild boar (D) and brown bear (E & F).

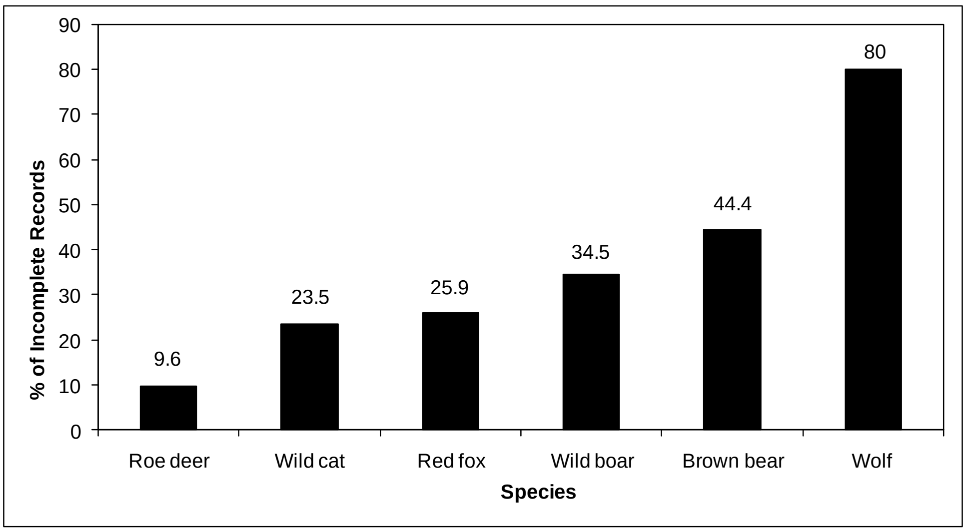

Figure 16. The ratio of incomplete camera trap records according to 7 target species.

3.1.2. Diversity Indices and Their Distribution over the Study Region

Camera trapping data for wolf, wildcat, red fox, pine marten, roe deer and wild boar was used to calculate the Simpon's, Shannon's and Brillouin's diversity indices to compare the species diversity of the 5 camera trap survey regions of Yaylacık Research Forest (Figure 17). Fifth region was the most diverse part of Yaylacık Research Forest with the highest diversity scores according to all of the three diversity indices (Table 1). The overall Simpson's and Shannon's diversity indices for the study regşon were 2.55 and 1.27 respectively. Camera trapping data for brown bear was not considered during the diversity index calculations.

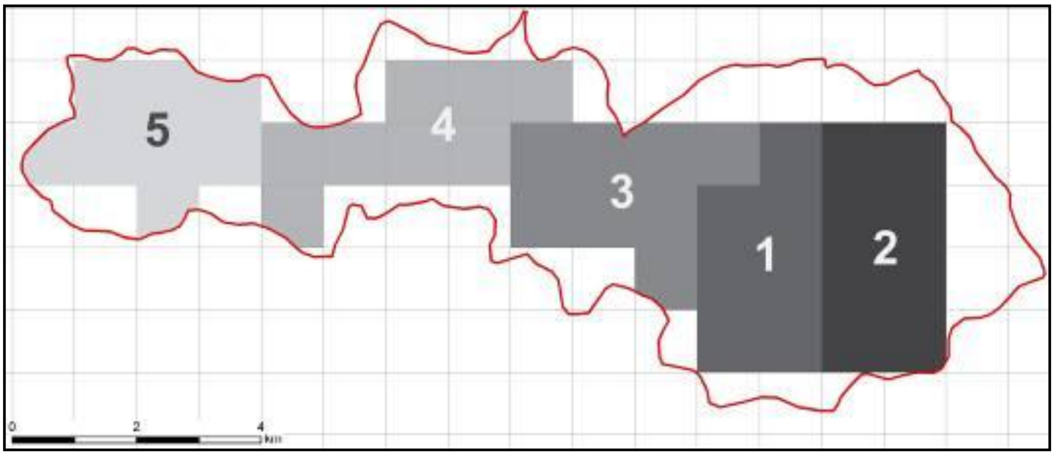

Figure 17. The 5 camera trap survey regions of Yaylacık Research Forest.

Table 1. The diversity scores of 5 camera trap survey regions according to Shannon's, Brillouin's and Simpson's diversity indices.

Diversity Indices	Region 1	Region 2	Region 3	Region 4	Region 5
Shannon's Index	1.14	0.98	1.07	1.17	1.29
Brillouin's Index	0.99	0.89	0.95	1.05	1.11
Simpson's Index	2.939	1.935	2.03	2.993	3.259

3.1.3. Similarities of Camera Trap Survey Regions in Relation to Species Presence

Camera trapping data for wolf, wildcat, red fox, pine marten, roe deer and wild boar was also used to ascertain the similarities of the 5 camera trap survey regions by using the presence/absence values of those species. Multidimensional scaling of the 5 camera trap survey regions showed that survey regions 3 and 2; 4 and 5 were similar in terms of presence/absence records of those species. Camera trap survey region 1 was distinct from all the other four camera trap survey regions (Figure 18).

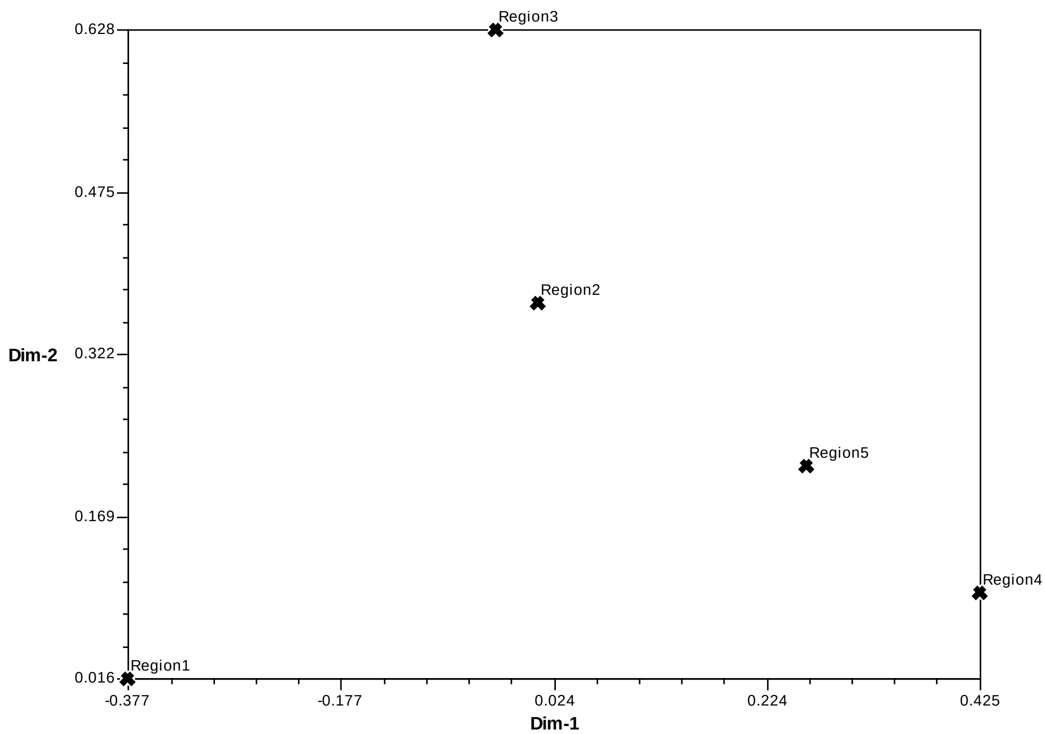

Figure 18. Multi dimensional scaling of the 5 survey regions according to the camera trapping data (Eugenie values for Dimension 1 and 2 are 51% and 32% respectively).

3.2. Activity Patterns of Seven Target Species

The distribution of the camera trap records according to camera trap locations and time of the day revealed the temporal and spatial activity of the 7 target species.

3.2.1. Temporal Distributions

The activity levels of 7 target species are presented in Figure 19. According to the camera trap survey results, the wolf, brown bear and red fox activity was highest after 18:00, which is the approximate sunset time for the study area. There was no wolf activity during the daytime. Brown bear activity was highest during 06:00-18:00 period. The wildcat was not active during 06:00-18:00 period. The pine marten was active only during 12:00-06:00 period. The roe deer was active through the day and night where as wild boar activity was mainly during 18:00-06:00 period.

When activity patterns of carnivores: Wolf, brown bear, red fox and wildcat were considered comparatively; it is evident that wolf, brown bear and red fox showed a similar activity pattern over 24 hours in Yaylacık Research Forest. The activity of all 3 carnivore species increased after sunset period (around 18:00) and similarly decreased after sunrise period (around 06:00). On the contrary, the wildcat activity was mostly observed during the day, its activity decreased after sunset. The activity patterns of the two large herbivore species, wild boar and roe deer were different.

When activity patterns of all 7 target species were considered, wolf, brown bear, fox and wild boar activity had a similar pattern and the activities of those 4 species increased after sunset where as their activities decreased after sunrise. The wildcat activity was observed to decrease from 12:00 to 24:00 while the activities of wolf, brown bear, fox and wild boar all increased in the same period of the day. The wildcat activity was the lowest when the activity of other carnivores was highest.

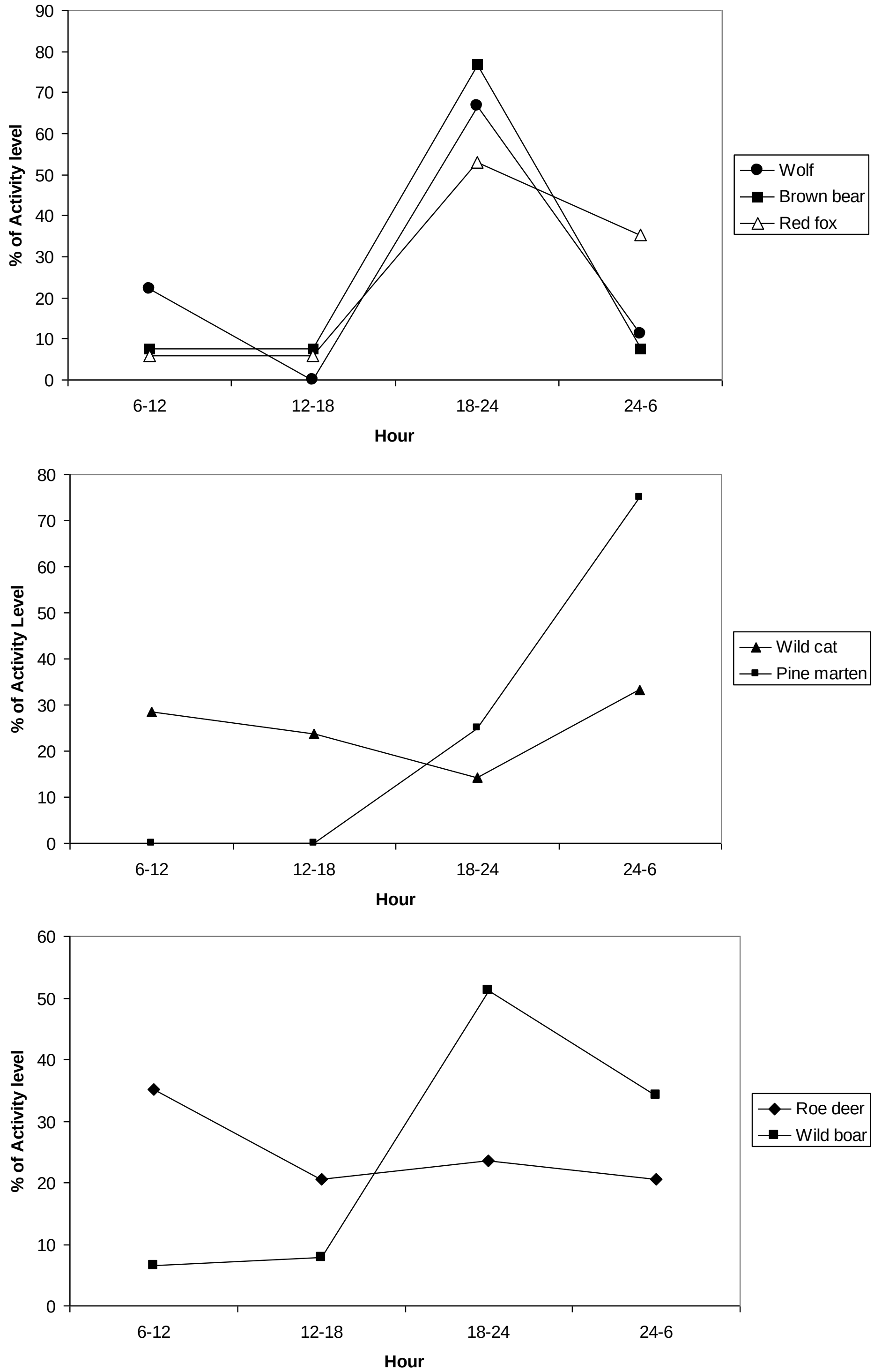

Figure 19. Activity levels of wolf, brown bear, red fox, wildcat, pine marten, roe deer and wild boar in Yaylacık Research Forest.

3.2.2. Spatial Distributions

Wildcat seemed to avoid red fox and their presence overlapped only 9% (3 out of 33 study cells) of the study region (Figure 20). Similarly, wildcat was not observed together with wolf in the study area. The distribution of wildcat and wolf camera trap records overlapped only 4.7% (1 out of 21 study cells) Wild boar was abundant in the study area wolf was active in specific locations only during 18:00-24:00 period of the day.

3.3. Encounters and Simulations in relation to Camera Trapping Efforts

The 5 consecutive camera trap surveys produced different number of camera trap records for each of the 7 target species.

3.3.1. Simulations of Camera Trapping Effort

Although the effort spent for gathering camera trapping data for the 7 target species was constant (1200 camera trap days for the first 5 consecutive camera trap surveys), the rate at which camera trapping data accumulated about each of the 7 target species was different among the species (Figure 21). Being encounter of only 0.66 during a 100 day of camera trapping effort, pine marten was the least encountered species where as the wild boar was the most encountered species with an encounter rate of 12.66 over a 100 day camera trapping effort. The encounter rate for wolf to red fox was 1:3.77 and encounter rate for wolf to brown bear was 1:1.44 in the study area. Similarly, encounter rate for roe deer to wild boar was 1:4.447.

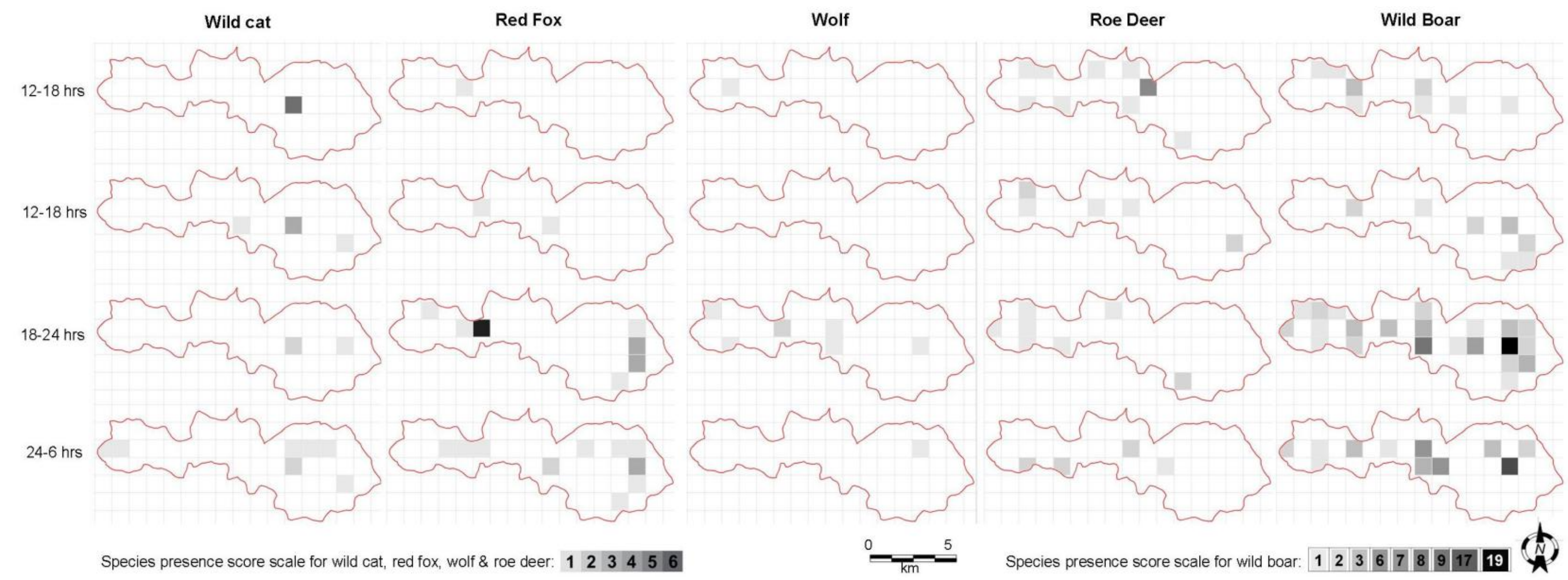

Figure 20. Spatial distribution of camera trap records of 7 target species over 24 hours in Yaylacık Research Forest.

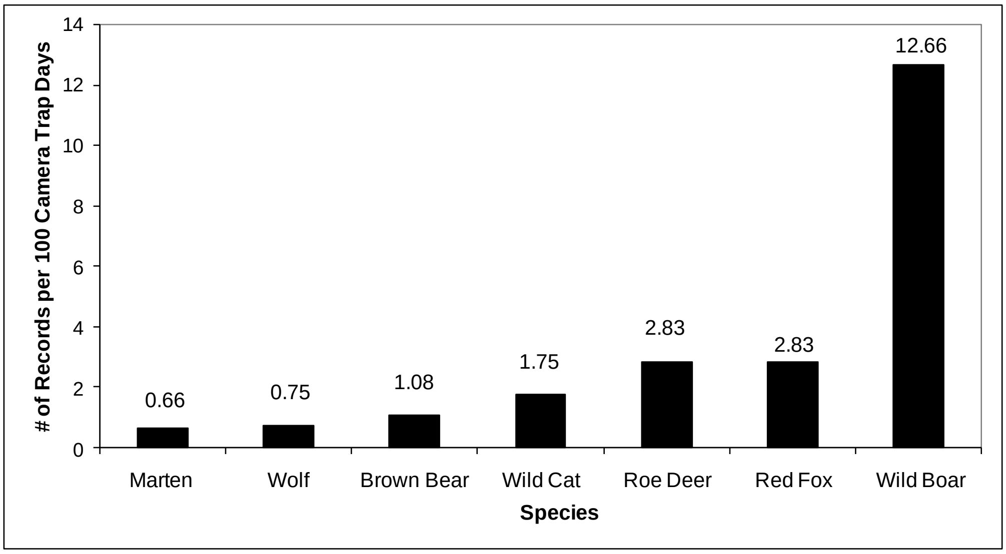

Figure 21. Encounter rates for 7 target species in Yaylacık Research Forest.

The number of wildcat camera trap records increased as the length of the camera trap surveys increased from 7 days to 13 days and then the number of camera trap records for wildcat did not differ much in the 14 day and 15 day surveys (Figure 22).

Similarly, brown bear records levelled off around the 13th day and conducting a longer camera trap survey did not produce more camera trap data for brown bear. The pine marten records levelled off around 10 days and conducting longer surveys (surveys that last 11 to 15 days) did not generate more pine marten camera trap data. . The number of brown bear, wild boar, roe deer and red fox records increased as the length of the camera trapping surveys increased from 7 days to 15 days.

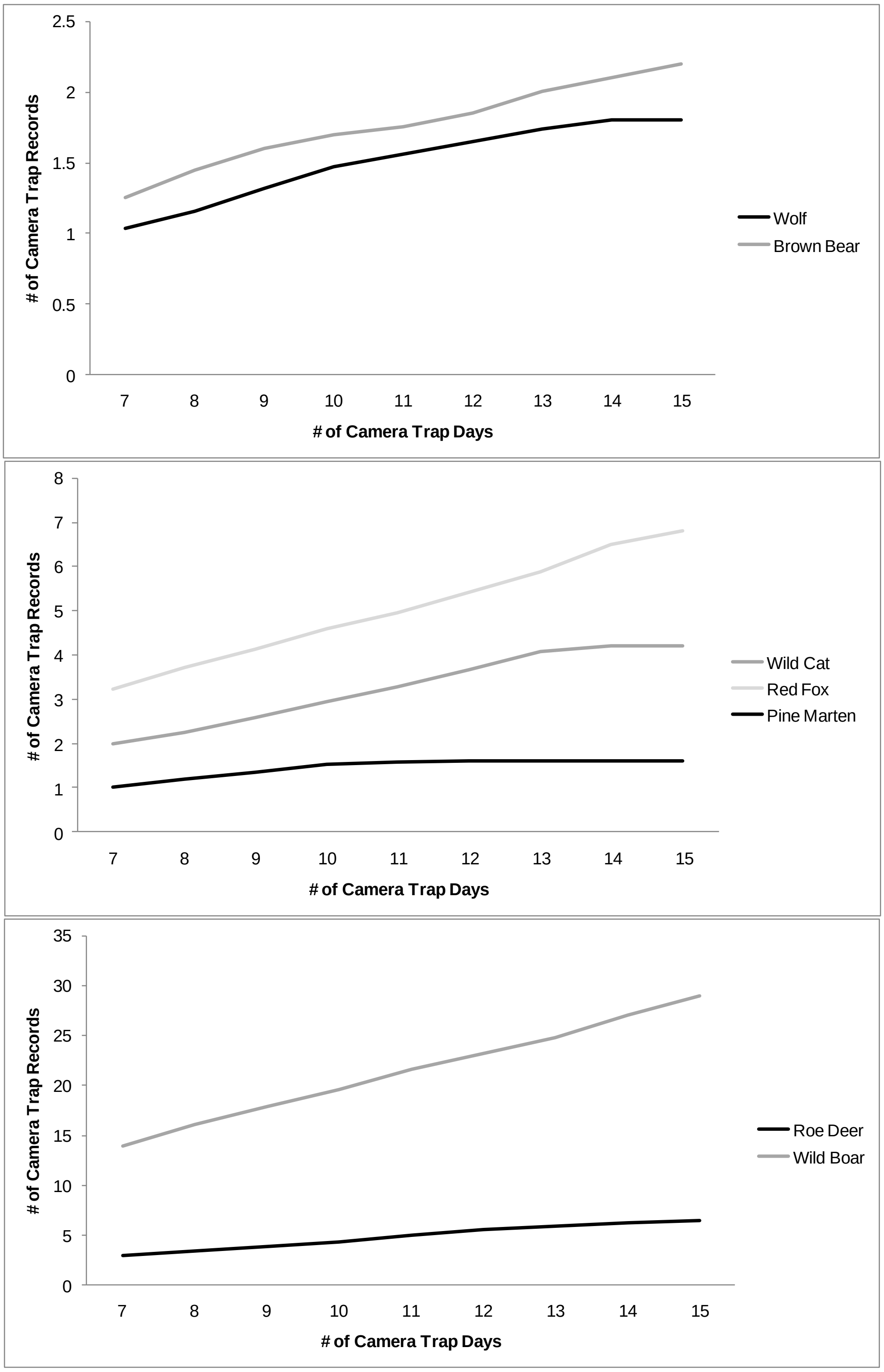

Figure 22. Cumulative number of camera trap records versus camera trap survey length for the seven target species. Wolf and brown bear are presented in the upper graph. Wildcat, red fox and pine marten are presented in the middle graph. Roe deer and wild boar are presented in the bottom graph.

3.3.2. Encounter Rates and Camera Trap Locations

There were 80 camera trap locations and 38.75% (31 of the 80 camera trap stations) of the cameras were placed on forest roads, 37.5% (30 of the 80 camera trap stations) of the cameras were placed in trails and 23.75% (19 of the 80 camera trap stations) of the camera traps were placed in valley-sides, passes and crests which were all classified as traps on other locations. Camera trapping capture rates for camera traps placed on forest roads, trails and other locations were significantly different from each other for red fox (χ^2= 6.238, df =2, p<0.05) and wild boar (χ^2= 9.145, df =2, p<0.05). Wild boar seemed to avoid trails. There seems to be no difference in captures of red fox with respect to the well defined two types of positions: the forest roads or on the trails, and red fox preferred these rather than others. Although, not significant, wildcat seemed to prefer trails. When capture records of those species are examined it seems that numbers of captures are equally distributed between the three classes of trap locations. In this test, pine marten was not considered since the species is somewhat arboreal.

Table 2. Camera trapping rates on forest roads, trails and other locations for 6 species. CTS stands for camera trap stations. CTNs stands for camera trap nights. All tests have 2 d.f.

	Overall	**Traps on Forest Roads**	**Traps on Trails**	**Traps on Other Locations**		
# of CTS	80	31	30	19		
# of CTNs	1200	465	450	285		
Species	**Number of Captures & (Capture Rate per 100 camera traps nights)**				**Chi-square Value**	**p Value**
Wolf	9 (0.75)	4 (0.86)	4 (0.87)	1 (0.35)	0.7963	0.6715
Brown bear	13 (1.08)	5 (1.08)	7 (1.52)	1 (0.35)	2.3376	0.3107
Wildcat	21 (1.75)	5 (1.08)	11 (2.39)	5 (1.75)	2.449	0.2938
Red fox	34 (2.83)	15 (3.23)	17 (3.67)	2 (0.70)	6.238	**0.0442**
Roe deer	34 (2.83)	13 (2.8)	17 (3.67)	4 (1.40)	3.475	0.1759
Wild boar	152 (12.66)	69 (14.83)	39 (8.48)	44 (15.4)	9.145	**0.0103**
All 6 Species	263 (21.9)	111 (23.87)	95 (20.7)	57 (20)	1.422	0.4912

3.4. Comparative Evaluation of Camera Trap and Track Surveys

Track surveys documented information on the presence of 7 target species in the study region (Figure 23). Detection of wild boar presence by camera trap surveys produced 72% more records. In other words, wild boar presence was detected in 18 study cells in which track surveys failed to document wild boar presence. Similarly camera trap surveys produced 57% more records for roe deer, 66.7% more records for red fox and 63.64% more records for brown bear compared to the track surveys. Similarly, detection of species presence by camera trap surveys produced 33.4% more records compared to track surveys for wildcat. On the other hand, track surveys produced 11.2% and 50% more species presence records respectively for wolf and pine marten respectively compared to camera trap surveys.

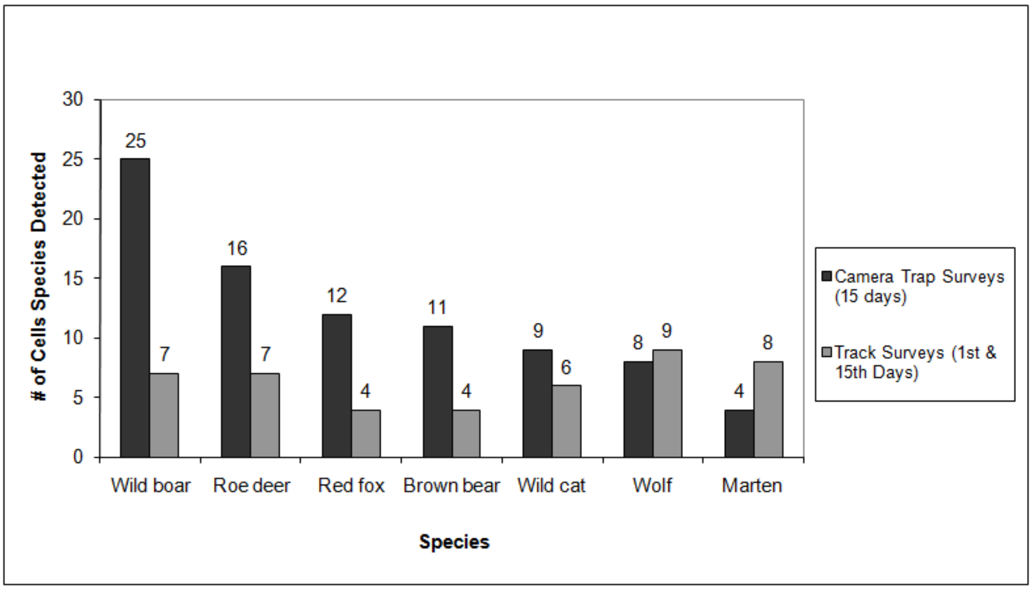

Figure 23. Detection of 7 target species by camera trap surveys and track surveys in Yaylacık Research Forest.

Both camera trap surveys and track surveys documented the presence of 7 target species in the study region. However, the detection of the species by 2 different methods differed slightly in the 5 consecutive camera trap surveys (Table 3).

In general camera trap surveys documented more species compared to track surveys alone. However, track surveys were better in detecting wolf, brown bear and pine marten where as camera trap surveys were better at detecting wildcat, red fox, wild boar and roe deer.

Table 3. Detection 7 target species by track surveys (TS) and camera trap surveys (CTS) in the 5 sub-regions of Yaylacık Research Forest.

	Region 1		**Region 2**		**Region 3**		**Region 4**		**Region 5**	
Species	**TS**	**CTS**	**TS**	**CTS**	**TS**	**CTS**	**TS**	**CTS**	**TS**	**CTS**
Wolf	+	-	+	+	+	+	+	+	+	+
B. bear	-	-	+	-	+	+	+	+	+	+
Wildcat	+	+	+	+	+	+	-	+	+	+
Red fox	+	-	-	+	+	+	-	+	-	+
Wild boar	-	+	+	+	+	+	-	+	+	+
Roe deer	-	+	+	+	+	+	+	+	-	+
P. marten	-	+	+	+	+	+	+	-	+	-
# of Species Detected	3	4	6	6	7	7	4	6	5	6

3.5. Identification of Individual Animals by Using Camera Trapping Data

Camera trap records of all 7 target species were checked to determine the species suitable for individual recognition. Wildcat and brown bear records were found to be suitable for the individual recognition.

3.5.1. Brown Bears

The total of 15 brown bear records were filtered to 13 by excluding the 2 duplicate records. Then 3 of the remaining 13 brown bear records were also excluded from the analysis since those records were incomplete, and were not suitable for individual identification. The remaining 10 brown bear records were examined by considering the body confirmation: body size and general appearance, shape and size of the head, and length of the legs (Figure 24).

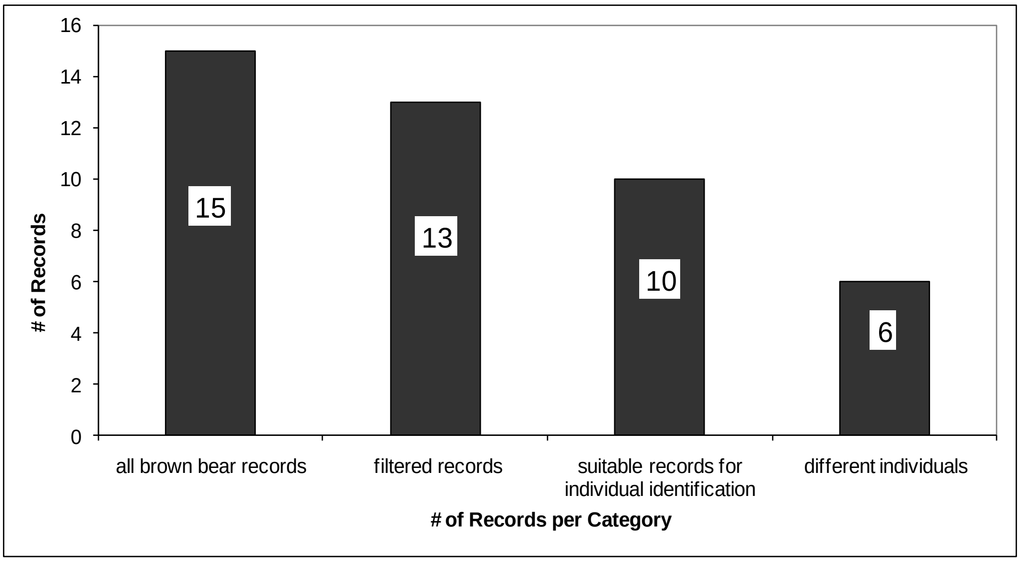

Figure 24. The steps of filtering the camera trap records of brown bears for individual identification.

The presence of any marks such as wounds on each animal in the records was also checked to aid the individual identification. The examination of the records showed that the 10 brown bear records were belonging to 6-8 different individuals. The most conservative estimate is that there are at least 6 different individuals of brown bears (Figure 25) in Yaylacık Research Forest as identified by 5 consecutive camera trap surveys with a capture rate of 5 individuals per 1000 camera trap days (Table 4). Representative photographs are presented in Figure 23. It is evident that the camera trap records belong to 2 female and 4 male brown bears and the estimated age group of the 6 individuals are presented in Table 5.

Table 4. Captures of brown bears during the 5 consecutive camera trap surveys.

Species	# of Camera Trap Days	# of Captures	# of Different Individuals	Captures/1000 camera trap days	Different Individuals/1000 camera trap days
B. bear	1200	13	6	10.8	5

Figure 25. Different individual brown bears (A to F) as identified from camera trap records.

Table 5. The individual brown bears as identified from camera trapping records.

Individual Code	Sex	Age
A	Male	Adult
B	Female	Young
C	Possibly female	Adult
D	Male	Young
E	Possibly male	Adult
F	Male	Adult
Total # of different individuals:		**2 females, 4 males**

3.5.2. Wildcat and its Population Estimation

A total of 22 camera trap records of wildcats were gathered from the 5 camera trap surveys (Figure 26). One record was found to be a duplicate record and it was filtered out. Then 21 wildcat records were checked and the camera trap records suitable for individual wildcat identification were selected. 13 records were found to be suitable for individual identification of wildcats in the study area. Different individuals of wildcats were identified by checking the general physical appearance and the unique tail patterns of the each individual. 8 different individuals of wildcats were identified as a result of 5 consecutive camera trap surveys with a capture rate of 6.66 different individuals per 1000 camera trap days (Table 6). Representative wildcat records are presented in Figure 27.

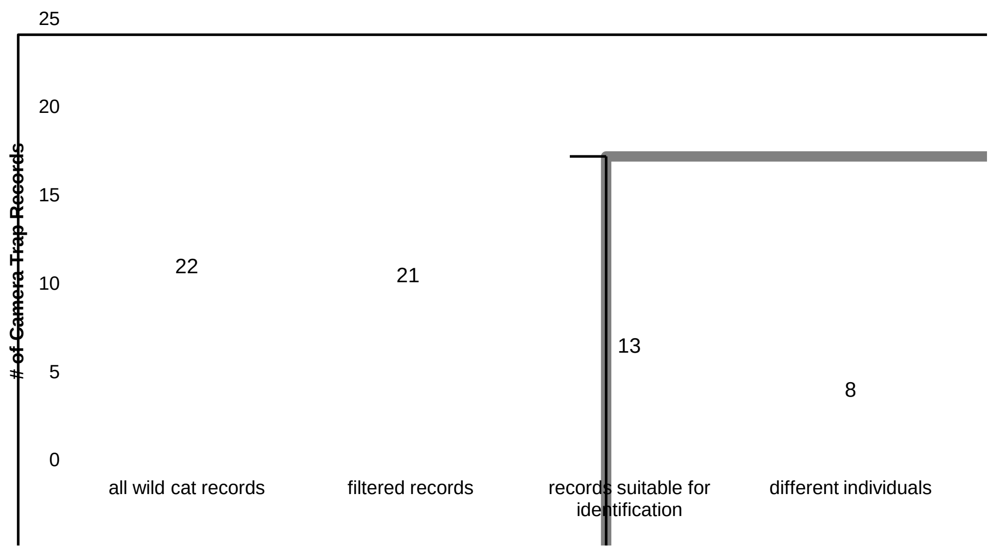

Figure 26. The steps of filtering the camera trap records of wildcats for individual identification.

Table 6. Captures of wildcats during the 5 consecutive camera trap surveys.

Species	# of Camera Trap Days	# of Captures	# of Different Individuals	Captures/1000 camera trap days	Different Individuals/1000 camera trap days
Wildcat	1200	21	8	17.5	6.66

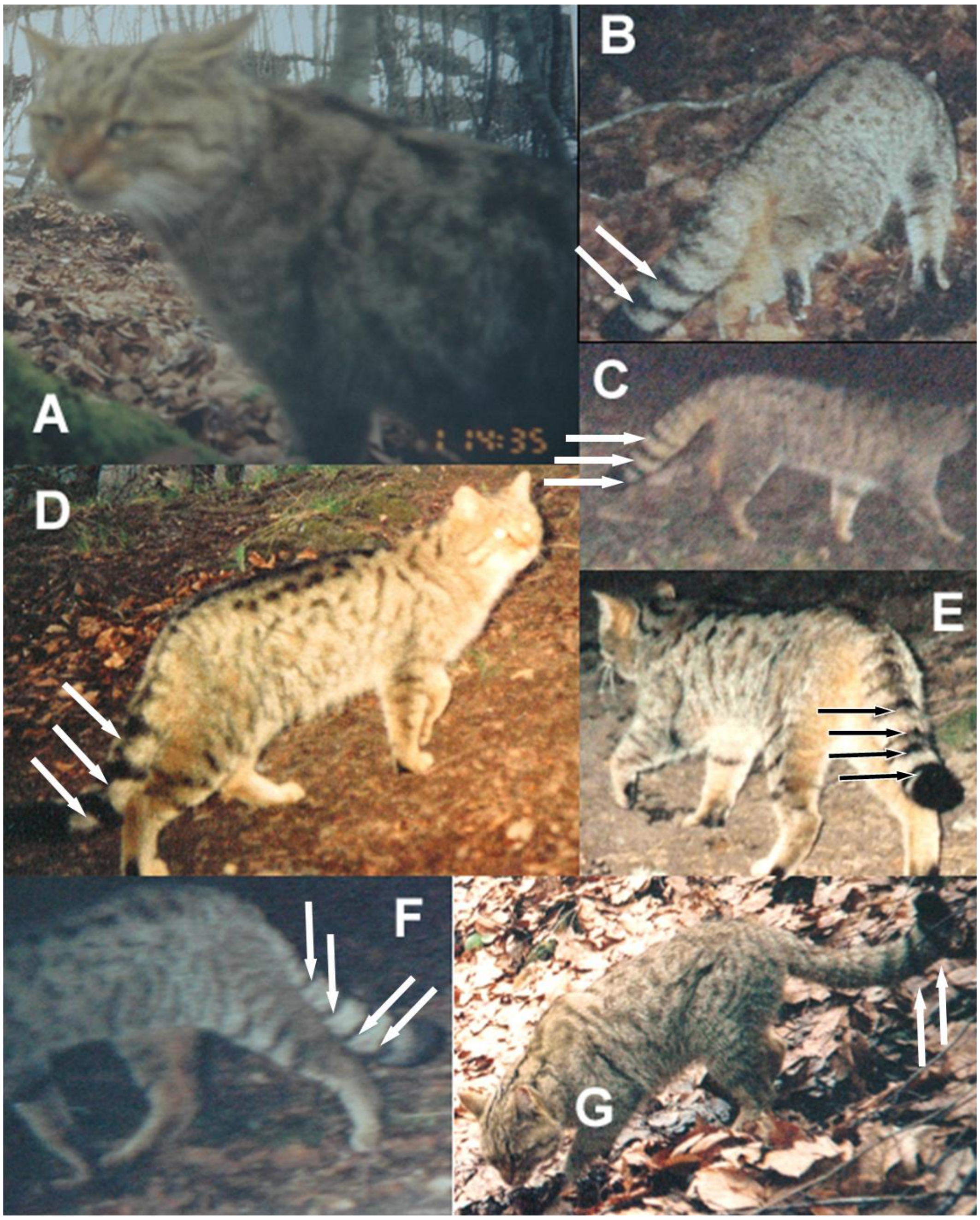

Figure 27. Representative wildcat records. Record A is not suitable for individual identification but records B, C, D, E, F and G are suitable for individual identification of wild cats. Different tail patterns that were used in identification of different individuals were shown for selected individuals.

In order to estimate the population size of the wildcats, the data for 5 consecutive camera trap surveys were considered. A total of 8 different individuals were identified. The camera trapping data was divided into five 15 day periods each constituting a tapping occasion. This resulted in wildcat capture history consisting of ones and zeroes where one indicates trapped and zero indicates not-trapped (Table 7).

Table 7. The capture history of 8 wildcats in Yaylacık Research Forest.

Wildcats	Capture History
individual 1	01000
individual 2	00101
individual 3	00110
individual 4	00001
individual 5	00001
individual 6	00011
individual 7	00101
individual 8	00100

The closure assumption (the assumption that the wildcat population did not change significantly during the study period) was checked by applying the closure test implemented in Mark software. The population was found to be closed from the statistical point of view (Closure test in Mark χ^2=8.34550, d.f.=6, p=0.21387). The model selection algorithm selected Model M_h which allows each animal had its own probability of being captured. The estimated population size was 9 wildcats (SE=2.8227) with a 95% confidence interval (CI) of 9 to 25.

CHAPTER 4

DISCUSSION

This section is organized and presented below according to the subtitles of the Results section.

4.1. Summary of Camera Trap Surveys in Yaylacık Research Forest

The 5 phase camera trapping survey revealed the presence of wolf, brown bear, wildcat, jackal, red fox, badger, pine marten, wild boar, roe deer, brown hare, and squirrel in Yaylacık Research Forest. The lynx was believed to be present all over Yenice Forest (Turan, 1984; Lise, 2005), however, the species was neither documented by the 5 phase camera trap survey nor ground surveys. Therefore it is evident that the lynx is not present in Yenice Forests at least during the time of the study in Yaylacık Research Forest. The jackal and brown hare was known to be absent in the study area by the locals and indeed, no evidence indicating the presence of brown hare and jackal was documented during the track surveys. However, both species were documented during the 5 phase camera trap survey.

The brown hare is known to be an open landscape specialist who has evolved in the Middle-Asian steppes and after the spread of agriculture in Europe, more habitats became available and the distribution of the species enlarged (Thulin, 2003). Yaylacık Research Forest is a continuous forest habitat with very few small forest openings therefore it is a marginal brown hare habitat. Therefore future studies may consider the possibility of brown hare presence in such marginal habitats in Turkey.

The documentation of jackal and brown hare by the camera trapping surveys and the failure of documentation of lynx by this study indicate that the local information available about the wildlife species in an area might not always be reliable and the information gathered from local sources should be double checked by the use of proper field research techniques. This has an important implication for Turkey where most of the wildlife information used in wildlife management decisions comes from local people and local authorities.

This study confirmed that although local information about wildlife in an area is important to consider, it cannot replace the necessity of proper field surveys by trained biologists as suggested by Can and Togan (in press.). In the absence of proper field studies, local authorities depend on local information when making decisions about wildlife management but information gathered from the local sources should be always verified by researchers and wildlife managers on the ground.

An intensive camera trap sampling approach was chosen during this present study. In total 16 camera traps were used to generate a total of 1200 camera trap days of observation. The number of camera traps used in other studies (Maffei *et al.*, 2005; Srbek-Araujo and Chiarello, 2005; Yasuda, 2004; Wegge *et al.*, 2004; Trolle and Kèry, 2003; Holden *et al.*, 2003; Jeganathan *et al.*, 2002) were in the range of 6-31 camera trap units with a total number of camera trap nights of 128-2280, (Karanth *et al.*, 2004; Maffei *et al.*, 2004; Yasuda, 2004; Silver, 2004; Wegge *et al.*, 2004; Trolle and Kèry, 2003; Jeganathan *et al.*, 2002). Therefore, present study was well within the range of other recognized studies in terms of the number of camera traps and the total length of the camera trap survey.

Sanderson (2004) pointed out that filtering of the initial camera trap records should be done before the data analysis to exclude double records, records that are not suitable for species identification and unknown records in which there is no animal in picture. 15.6% (63 of 402) of the entire camera trap records were unknown, the records that has no registered animal in the photograph, and this was related with the speed of the animals passing in front of the camera traps as well as how fast the camera traps were to take the picture once the heat-in motion is detected by the camera trap sensor. Therefore, for future studies, the reaction speed of camera trap units should be considered by the researchers when selecting the brand and model of the camera trap units. In this study 76.5% of the entire camera trap records were suitable for further analysis. In a similar camera trapping study, Yasuda (2004) found that 22.5% of the records were suitable for analysis. Similarly, Azlan and Sharma (2006) and Srbek-Araujo and Chiarello (2005) reported that the percentage of suitable camera records for analysis were 64% and 20% respectively. Compared to other studies (Yasuda, 2004; Azlan and Sharma 2006; Srbek-Araujo and Chiarello 2005), the present study archived a higher rate of success in collecting usable camera trap data. This was achieved by the competence of the study team in locating and identifying the tracks and signs of the target species, and use of that information in setting the camera traps. This implies that the ability of researchers in tracking signs and tracks of species of concern play an important role in the success of camera trap studies. The intensive camera trap sampling approach followed in this present study might also have a positive effect in achieving a high rate of success in gathering camera trap data in the study area.

Wolf had the most incomplete camera trap records among roe deer, wildcat, red fox, wild boar and brown bear. 80% of all the camera trap records of wolf were in-complete which means that in those records only half of the animals in photograph were registered. Wolves are known to travel as fast as 56-64 km per hour, 42.4 km-49.4 km between the kills and much of this travel involves searching for prey and may occur in a single night of hunting (Mech and Boitani, 2003). This indicates that wolf probably travels faster than all other species in the study area probably in the search of its prey: wild boar and roe deer and this probably explains the high ratio of incomplete records compared to other species in present study.

Shannon's, Simpson's Indices, the most widely used diversity indices (Spellerberg, 1992; Molles, 2000) were used to calculate the diversity of the study area and its 5 sections. Both indices pointed out that the most diverse part of the study area in terms of wolf, red fox wildcat, roe deer, wild boar, pine marten was the western part of the study area which was numbered as the fifth survey area. The least diverse part of the study area in terms of the presence of those six species was the second survey area. Krebs (1999) suggests that Brillouin's Index is more appropriate in measuring diversities for communities. Therefore Brillouin's Index was also calculated. The fifth and forth camera trap survey regions were also confirmed to be the first and second highest diversity spots by Brillouin's Index. When calculating the diversity indices, brown bear records were not considered and they were excluded since the activity of brown bear is dependent on the season, it increases from winter to spring period as the 5 phase camera trap survey continues from camera trap survey region 1 to 5.

Multidimensional scaling was used to visualize and compare the differences of five survey regions in terms of species diversity. The use of multidimensional scaling to visualize the data might help the wildlife authorities to distinguish areas that are similar in terms of species presence at larger scales. This information might be particularly critical in identifying and selection of protected areas as well as various forestry activities. Multidimensional analysis showed that the fifth and forth survey regions are similar to each other according to the presence of wolf, wildcat, red fox, pine marten, roe deer and wild boar. The third and second camera trap survey regions were similar in terms of the presence of those six species. The first camera trap survey region was distinct from all the other camera trap survey regions since wolf and red fox was absent. The habitat features in terms of terrain and vegetation are similar throughout the study area. Therefore the absence of wolf can probably be explained by the presence of the forestry station and the associated human disturbance in the first camera trap survey region. The locals also have been observed to utilize this region from time to time. This might be a reason for wolf to avoid the region.

Previous research has shown that presence of fox seems to be associated with wolf presence since fox utilizes the prey remains left from wolves in Bolu, an area which is only about 50 kilometres southwest of Yaylacık Research Forest (Can, 2000). Red foxes were observed to be visiting all wolf kills and red fox populations were observed to be high where they occur in areas together with wolves (Mech and

Boitani, 2000). This probably explains the absence of red fox together with wolf in the first camera trap survey region. In all other regions of the study area, wolf and red fox were present together.

4.2. Activity Patterns of Seven Target Species

Wolf was most active around 18:00pm-24:00pm in Yaylacık Research Forest. It was also active during 06:00am-12:00pm which is daylight period. The wolf is largely nocturnal in Europe due to persecution by man (Macdonald and Barrett, 1993) therefore the observed difference in wolf activity period in Yaylacık Research Forest might be explained by the lack of significant human disturbance to wolf in the area.

It was observed that brown bears in Yaylacık Research Forest were most active during 18:00pm-24:00pm and exhibited a very little activity during the rest of the day. Although the brown bear is more diurnal where undisturbed (Macdonald and Barrett, 1993), activity data from this study does not indicate significant diurnal activity during the study period. The fox showed maximum activity during 18:00pm-24:00pm and it was also active during 24:00am-06:00am period in the study area. Fox is known to be nocturnal and crepuscular but diurnal when undisturbed (Macdonald and Barrett, 1993). However, the fox avoided activity during most of the day time period in Yaylacık Research Forest.

Wildcat is largely crepuscular and nocturnal species (Macdonald and Barrett, 1993). The data shows that wildcats in Yaylacık Research Forest were active during night (24:00am-06:00am period) but they were also active during the day light time (06:00am-18:00pm) showing a diurnal activity pattern. In wildcats, most hunting occurs at night (Sunquist and Sunquist, 2002). Present study also indicated that wildcats are most active during night (24:00am-06.00am period). Wildcat had a different activity pattern when compared to other carnivores by being least active during the period when wolf, brown bear and red fox were most active (18:00pm-24:00pm). There was very little spatial overlap between the wildcat records and wolf-brown bear records combined (not shown in the present study) and there was little overlap between wildcat and red fox camera trap records. Carvalho and Gomes (2001) found extensive niche overlap between red fox and wildcat in Portugal. Red fox is a well-known generalist predator with opportunistic feeding habits and wildcat is considered a carnivore species specialized in rodents and lagomorphs (Carvalho and Gomes, 2001).Considering the very low abundance of lagomorphs in Yaylacık Research, wildcats are probably preying upon rodents like red fox does. Therefore it is possible that wildcat is avoiding red fox by being least active in the periods when red fox is most active.

Wild boar is mainly crepuscular and nocturnal (Macdonald and Barrett, 1993) and similarly, wild boar activity was maximum during 18:00pm-06:00am in Yaylacık Research Forest. Roe deer is largely crepuscular and forages throughout night in September-April period but it is more diurnal if undisturbed (Macdonald and Barrett, 1993). We observed that roe deer in Yaylacık Research Forest were diurnal with activity patterns distributed throughout the day. The pine marten activity data shows that the species was active during 18:00pm-06:00am period and it was not active during day light period. This observation also confirms that pine marten is mainly crepuscular and nocturnal (Macdonald and Barrett, 1993).

Considering the fact that the access of people to Yaylacık Research Forest is controlled by the forestry service and disturbance caused by humans is very low in the study area, it is likely that the activity of the all 7 target species in Yaylacık Research Forest reflects the natural activity patterns of the 7 target species. However, more information could have been gathered about the activity patterns if sampling could be done over several seasons.

4.3. Encounters for Seven Target Species

The number of camera trap records belonging to brown bear, red fox and wild boar increased with the increased number of camera trap days. In other words, the more camera trap effort is spent, the more camera trap record is collected for those three species. On the other hand, increasing the camera trapping effort did not cause an increase in the amount of camera trap records for wolf, wildcat, pine marten and roe deer after certain amount of camera trapping effort spent. The number of wolf records increased as the number of camera trap days increased from 7 to 14 days and conducting a 15 day camera trap survey did not cause an increase in the camera trap records for wolf. Similarly, conducting more camera trap surveys for more than 13 days for wildcat and 10 days for pine marten did not produce more camera trap records.

Karanth and Nichols (2002) suggest that each phase of a camera trap survey should last 5 to 30 consecutive days. However, there is a need to standardize camera trap studies as Kelly (2008) suggests since even when the same species is considered, the amount of camera trapping effort, which is a function of the number of camera trap units used and the length of the camera trap survey, varies from one study to another (Kelly, 2008). In fact, having a standard methodology and established guidelines for conducting camera trap studies will result in a significant increase in the number of researchers and studies (Tobler *et al.,* 2008).

Results of the present study indicates that conducting 14 day long camera trapping survey for wolf, 13 day long camera trapping survey for wildcat, 10 day long camera trapping survey for pine marten and 11 day long camera trapping survey for roe deer will be sufficient in similar studies conducted in similar forest habitats with the same number of camera trap units.

When the encounter rates for the 7 target species in Yaylacık Research Forest was considered, marten had the lowest encounter rate with a value of 0.66 per 100 camera trapping days. The observed minimum encounter rate for marten can probably be explained by their three dimensional spatial use of woodland structure (Rondinini and Boitani, 2002). Pine martens are well adapted to climbing (Rondinini and Boitani, 2002), they travel through treetops (Macdonald and Barrett, 1993) and their nests are located in the trees (Schroepfer and Wiegand, 1997). Therefore it was the least encountered species by the camera traps during the study.

Wild boar had an encounter rate of 12.66 per 100 camera trapping days and this value was the highest encounter rate among those of the 7 target species in Yaylacık Research Forest. The observed highest encounter rate of the wild boar can possibly be explained by the high abundance of the species in Yaylacık Research Forest, as is the case in Turkey (Turan, 1984) and in central and Western Europe (Macdonald and Barrett, 1993). Female wild boars travel with their young (Macdonald and Barrett, 1993) as a group. 21% of the wild boar (32 out of 152) camera trap records in present study were belonging to wild boar groups. It is evident that animals that live in groups will be more readily registered by camera traps since at least one of the individual in the group will trigger the camera trap when a group of wild boar passes in front of a camera trap.

The red fox was the second most encountered species with a species encounter rate of 2.83 records per 100 camera trapping days. Probably, this is also related with the abundance of the species in Yaylacık Research Forest. Red fox is most widespread and abundant carnivore in the world (Macdonald and Barrett, 1993) and similarly it is abundant all over in Turkey (Turan, 1984; Demirsoy, 1996).

Roe deer are continuously distributed in northern Turkey (Turan, 1984) and it is less abundant compared to that of wild boar with an encounter value of 2.83 records per 100 camera trapping days. The higher encounter rate of roe deer in the study compared to that of wildcat (1.75) is probably related with its abundance.

The encounter rate for wildcat was 1.75 records per 100 camera trap days. According to Turan (1984), wildcat is continuously distributed in northern Turkey. The reported home range values for wildcats are in 0.6 km^2 – 12.70 km^2 (Macdonald and Barrett, 1993) which is much smaller than the home ranges of wolves (given below) and brown bears (given below). Wildcat is probably more abundant than wolf and brown bear therefore the encounter rate for wildcat was higher than the encounter rates for wolf and brown bear in the study area.

The reported home ranges for brown bears in Europe are in 56 km^2 – 4000 km^2 range where the reported home ranges for wolves are in 100 km^2 - 1000 km^2 (Macdonald and Barrett, 1993). However, bears travel on average 2-3.5 km a day (Macdonald and Barrett, 1993) which means that they have probably spent more time in the study cells occupied by camera traps at a given time during the study.

Wolves, on the other hand, may travel up to 72 km in a day (Mech and Boitani, 2003) which means that at a given time of the study wolves spend probably less time in the study cells occupied by camera traps. In addition, it was evident from camera trap records that wolf travelled on average faster than in other species since in 80 % of the wolf camera trap records (4 out of 9), half of the animal was registered on the photograph resulting from the slower action of the camera trap unit in relation to the animal's speed. When the animal's speed is even faster, an unknown camera trap record occurs since the speed of the animal is even much faster than the camera trap's speed. Considering the high ratio of incomplete camera trap records for wolf, it is possible that some of the unknown camera trap records (63 out of all camera trap records gathered, 402) belonged to wolf as well.

Encounter rates present the number of camera trap records gathered in a camera trap survey in relation to the camera trapping effort spent. Therefore, encounter rates can be used to compare differences in the number of animals of a particular species in a given area between seasons or to compare the number of animals between different areas as similar to an index count (Rabinowitz, 1997). Encounter rates can also be used to compare the amount of activity of a given species in a study area between seasons.

It must be noted that these comparisons should be made on a species specific manner but not between species. Encounter rates indicate at a certain degree the relative abundance of different species (Tobler *et al.,* 2008). Although there is an ongoing debate in the literature about the reliability and use of encounter rates as a measure of density of the species in the study area, the fact that camera traps cause much less error compared to other indices such as the variation in the ability of technicians and field conditions (Kelly, 2008) supports the argument Therefore, we believe that encounter rates give at least a crude indication of relative abundances of species better than the other widely used monitoring systems such as hunter observations, local reports, den counts, track counts, harvest data (Linnell *et al.,* 1998).

The encounter rates did not change according the locations of camera traps in gathering wolf, brown bear and roe deer camera trap records. However, wild boar seemed to avoid trails whereas wildcat preferred trails. Wildcat is known to hunt in the open areas such as forest clearings, meadows (Macdonald & Barrett, 1993). Similarly, the trail preference of wildcat in the study area might be related with the presence and movement of small rodents – the prey base of wildcat- along the trails. It seems that the roe deer did not avoid the trails which were used by wolves perhaps this is because the roe deer activity did not overlap with wolf activity temporally.

4.4. Comparative Evaluation of Camera Trap and Track Surveys

Camera trapping was found to be more effective in detecting brown bear, wildcat, red fox, roe deer and wild boar since camera trapping detected their presence in more study cells compared to those identified by track surveys. On the other hand, track surveys detected presence of wolf and pine marten in more cells than the camera trapping surveys did. In general, camera trapping surveys detected more species in the study area compared to track surveys. Track surveys depend on the recognition of animal tracks and signs by the researchers, therefore, when the substrate is not very suitable for tracking, it is not always possible to recognize and properly identify the tracks in the forest. Yaylacık Research Forest is a difficult habitat for conducting track surveys due to limited visibility in the forest, the presence of mainly deciduous trees which result in lots of debris on the forest floor which in turns makes it very difficult to recognize and identify tracks.

Track surveys were conducted during the first and the last day of camera trapping surveys and the relative amount of effort spent in track surveys were not equal to camera trapping surveys. However, during a track survey, 2 experienced trackers searched for the sign and tracks of the 7 target species in a transect of 1 km in length and 5 meter wide strip. It was assumed that not all of the animal tracks that were left in the study cells were destroyed by wind, rain, snow and at least some of the tracks were available and identifiable to be checked in the last day of the track surveys which is also the last day of camera trapping surveys.

The trapping effort spend in track surveys (2 days per study cell) were not equal to the camera trapping effort (15 days per study cell), however, they were considered to be comparable since in track surveys an area of 1 km in length and 5 meters in width were searched by 2 trackers. Whereas, camera traps were steady at the point they were set and they could only sense a limited area in front of their heat in motion sensors.

4.5. Identification of Individual Animals by Using Camera Trap Data

Camera trapping studies combined with capture-recapture statistical modelling has been used to estimate population sizes of wild carnivores (Trolle and Kèry, 2003). There have been such studies on ocelots, tiger, snow leopard, leopard, jaguar (Henschel and Ray, 2003; Trolle and Kèry; 2003; Karanth *et. al.*, 2004; Jackson *et al.,* 2005).

In such studies, researchers have identified the different individuals by considering the different coat patterns of the animals captured in their camera trap records. The species such as ocelot, tiger, and jaguar are large individuals that are easier to identify from the camera trap records. Species such as brown bears, wolves are not usually easy to identify individually since they do not have always such distinguishable coat patterns that can help identification on an individual bases.

Species such as wild boar, roe deer, marten, badger are even more difficult to identify on an individual bases due to close resemblance of individuals within each species. Similarly, in this study, it was not possible to identify all of the wild boar and roe deer records on an individual bases.

Wildcat and brown bear records were found to be good enough to make conservative estimates of different number of individuals found in Yaylacık Research Forest. As Trolle and Kèry (2003) did for ocelots, an attempt was made to identify the individual wildcats using the body size, shape and the tail coat patterns.

The total number of filtered records for wildcat was 21 but 13 of those records were considered for individual identification. A total of 8 different individuals were identified and their capture histories were constructed. The population size for the wildcats was estimated by using the Capture program in MARK for the first time for a particular area in Turkey.

The estimated wildcat population size was 9±2.8227 individuals with a 95% confidence interval of 9 to 25 in Yaylacık Research. According to Macdonald and Barrett (1993), densities of wildcats vary from 1 cat per 0.7-10 square kilometres. Considering the size of the study area (50 square kilometres), the estimated population size of wildcat in Yaylacık Research Forest is comparable to Macdonald and Barrett's (1993).

A study in Hungary showed that the home ranges of wildcats range between 1.5 to 8.7 square kilometres and another study in France showed that this range is about 1.84 square kilometres for females and 2.2 to 12.70 square kilometres for males (Sinquist and Sinquist, 2002). According the Nowak (1991), the home range of a wildcat can be as small as 0.5 square kilometers.

There is no information on the home ranges of wildcats in Turkey, and it requires a telemetry study to find out the home ranges of wildcats in Yaylacik Research Forest. However, male wildcats may restrict themselves to a forest home range and resident male home ranges overlap with 3-6 females (Macdonald and Barrett (1993) or with 3-5 females (Nowell and Jackson, 1996) and there is little overlap between the individuals of the same sex (Nowell and Jackson, 1996). Therefore when these available figures for home ranges, size of the study area and confidence interval for the population size estimate (9 to 25 individuals) are considered. The home ranges of wildcats are probably in the 2-6 square kilometres range in Yaylacık Research Forest.

There is controversy over what is wildcat and whether if wildcats can be defined by morphological criteria (Beaumont et al., 2001). In addition it is not really possible to estimate the degree of admixture since the gene frequencies in the native wildcat populations prior to hybridization with domestic cats (Beaumont *et al.*, 2001). However, there have been studies to distinguish pure wildcats from feral domestic cats and their hybrids on the basis of morphological characteristics (Kitchener *et al.,* 2005), identification of hybrids and level of hybridization can be properly done by defining the pure wildcats morphologically and genetically and then conducting proper genetic studies. The importance of hybridization of wildcats is still in debate (Nowell and Jackson, 1996). On the other hand, according to a study, the probability of genetic flow between sympatric populations of wildcats living in forests and domestic cats is very low (Nowell and Jackson, 1996). According to a study from Germany, wildcats spent 90% of their time in the forest and did not range more than 1500m from the forest edge and domestic wildcats have almost never been seen in the forest (Pierpaoli *et al.,* 2003). In addition, at a recent symposium on wildcats (The Biology and Conservation of the European Wildcat Symposium) in 2005, anecdotal observations of wildcats being dominant over domestic cats and adult domestic cats being afraid of wildcat kittens of few weeks were presented.

Yaylacık Research Forest is a continuous dense forest habitat with hard winter conditions where other carnivores as wolf, brown bear and red fox are resident. During the study period, only one domestic cat was documented in a village located about 2 kilometres from the edge of the study area. Therefore, the presence of feral domestic cats is very unlikely and the genetic integrity of wildcat population in Yaylacık Research Forest is not currently threatened as the wildcat population in Europe (Pierpaoli *et al.,* 2003).

The present study provided the very first estimation of a wildcat population size for a particular site in Turkey. Therefore there are no population figures from any other area and comparison of the population size of wildcats in Yaylacık Research Forest with that of other areas in Turkey was not possible.

13 of the brown bear records were checked to identify the different brown bears in those records. In brown bears, body confirmation, the coat coloration and presence of scarf made it possible to identify different individuals. Two international bear biologists Dr. John Beecham (personal communication, Turkey, 2006) and Dr. Owen Nevin (personal communication, Turkey, 2006) helped and independently confirmed the sex, age and identification of individuals. In brown bears, adult males typically have "teddy bear" head; broad and ears appear to be small and stomach hangs close to the ground and the legs appear stubby. Whereas sub-adult males appear leggy (long legs relative to body size) and there is lots of space between the stomach and ground. Head is typically narrower and the ears appear to stand up and are large relative to head size. The muzzle is often broader than you would see in a female. Adult females have relatively narrower heads not as broad as a males head. They have shorter legs and stomach is close to ground. However, really old females that are 18+ years old have many of the characteristics of a large male, but their body size is too small. Sub-adult female has very narrow muzzle and head. They appear leggy in appearance, but not nearly as much as young males. When 10 brown bear records were examined about 6-8 different individuals were identified considering the above discussions on bear body confirmation. However 6 different individuals were proposed as a conservative estimate.

4.6. Practical Considerations for Future Camera Trap Surveys in Turkey

The variety of camera traps increase as the demand from the research community increases. Present study used camera trap units that work with negative or positive photographic films. Since at the time of the purchase of the camera trap units, there were few brands and models with digital cameras which were reliable and were very expensive, on the $1000-$2000 range.

Today, the improved models can be bought at half of that price range. The camera trap units that work with photographic films can take up to 36 photographs since photographic film producers does not produce rolls of films with higher photograph capacity. Therefore, the camera trap can take only up to 36 photographs. Therefore, frequent visit is necessary to the camera trap site to check whether the film is all used up or not.

However, frequent visit such as visiting the study area once a week may not be feasible depending on the location of the study area. This will in turn increase the costs associated with camera trap survey. Therefore, using a camera trap unit that has digital camera inside will eliminate this problem given that the memory card of the camera trap unit has enough capacity. Using memory card that has 1 gigabyte capacity will enable the researcher to take about 500 photographs with the highest quality version. The maximum amount of photographs taken in a 15 long camera trap survey in Turkey was 400 (Ö. Emre Can, unpublished data) therefore even in the presence of large wild boar groups, 1 gigabyte memory card will be sufficient during a 15 day long camera trap survey. The new digital camera traps have a fast response and can take photographs rapidly once an animal is detected. The number of unknown or incomplete camera trap records will be less in proportion to the complete records when such fast camera traps are used.

The risk of theft and vandalism is an important issue to consider when conducting camera trap surveys. Choosing camera traps painted in natural colours will be helpful in hiding the camera trap in the field in case there is risk of vandalism and theft. Similarly, choosing a model that can be securely locked to a tree will discourage any person that may steal the camera trap unit. Most of the camera trap units in the market will require a metal protective cover since they are fragile in design once they are out of the package. Some models have factory made protective metal cases, however they are heavy and shipping costs to overseas will be high. Therefore, one can try to design and create it locally.

The number of camera trap units is important to consider in any camera trap study. However, most of the time, the minimum number of camera trap units that will be used determined by the size of the budget allocated for a particular study rather than other factors such as the study species, size of the study area etc. Ideally, when enough number of camera trap units is available for a given study, and the study area is small, covering the whole study area and conducting the camera trap survey all at once in 5-30 consecutive days is suggested (Karanth and Nichols, 2002). The effect of seasons should be considered when surveys last for several seasons and species data (such as for brown bears) should be considered with caution due to the affect of seasons on the activity levels.

In reality, the number of camera trap units are limited and study areas are not small since the species that are subject to camera trap studies are mainly large mammals that has large home ranges. When this is the case, the study area is often divided into subunits and then a several phase camera trap survey is conducted (Karanth and Nichols, 2002).

The methodology of this present study was based on the camera trapping methodology used by Karanth (1995), Karanth and Nichols (2002), Karanth *et al.* (2004), Trolle and Kèry (2005), Trolle *et al.* (2007) and Simcharoen *et al.* (2007). In accordance with the previous camera trap studies mentioned above, a 5 phase camera trap survey (each phase lasts for 15 days) was conducted in the study area. In between these two steps, the camera trap units need to be checked for malfunctioning, the photographic film and batteries should be changed with new ones. The whole process requires careful planning of logistics and such camera trap surveys costs more since it involves regular round trips to the study area. In a 2 phase camera trap survey that will last for 15 days each in a forest habitat similar to the one in this present study, a minimum of additional 4 days is necessary to place 10-15 camera trap units given that the research team is composed of 2-3 persons and they work from the morning until the sunset in a given field day. It is also assumed that the study team is based on site and do not spent extra time to reach to do the study area but only travel within the study area.

Before the first day of the fifteen day camera trap survey, a minimum of 1 day is required to install 15 camera trap units. On the sixteenth day, the next day after the end of first phase (the first 15 days of the camera trap survey), the study team will spent another day to reach to the site to collect and bring the camera trap units to the base camp. That evening should be spent for the control of 15 camera traps, taking out the rolls of films and loading fresh batteries with new photographic films and preparing the camera trap units for the next phase of the survey. On the seventh day, the camera trap units will be placed into their new locations and after the end of another 15 days, they will be removed from the field and photographic films will be collected. It must be noted that it is assumed here that the survey team has prior experience in camera trapping surveys, locations of the camera traps were determined before the actual survey, and the survey is being conducted during a day with average weather conditions.

Camera traps must be installed in the study area in a way to maximize the capture probabilities of target species (Karanth and Nichols, 2002; Simcharoen *et al.,* 2007). Camera traps must be placed in areas where there is evidence of frequent target species activity (Karanth, 1995; Karanth *et al.,* 2004; Jackson *et al.,* 2005; Simcharoen *et al.,* 2007; Trolle and Kèry, 2005; Tobler *et al.,* 2008; Trolle *et al.,* 2007) and presence of tracks, scats, feeding signs should be observed to identify the sites that are highly used by the target species of a given study. Random selection of the trapping locations will result in most camera traps without any captures of the target species since animals do not move randomly in nature (Karanth and Nichols, 2002; Jackson *et al.,* 2005).

If the purpose of the camera trap survey is to produce inventory of species, to discover the temporal and spatial activity patterns, group size then only 1 camera trap can be set in each camera trap location (Tobler *et al.,* 2008). This will reduce the camera trap survey costs and a larger area will be covered at a time. If the purpose of the camera trap survey is to individually identify the animals and then make population estimates and density estimates, then two camera trap units must be placed at each selected camera trapping site to photograph the both sides of the passing by animals.

On the other hand, there is a new approach for estimating the density of target species without the need for recognition of individual animals (Rowcliffe *et al.*, 2008). This new approach involves a modelling of the contact between animals and camera traps in a similar way to the mechanistic models that have been used to describe the rates of contact between animal groups by the biologists (Rowcliffe *et al.*, 2008). The model of Rowcliffe *et al.* (2008) provides a factor that scales the camera trapping rate linearly with animal density.

Another key issue to consider is the maximum spacing between any two camera trap locations. The maximum spacing should be arranged in a way that no holes should be left in the sampled area meaning that all home ranges of target species must be covered by camera trap units and no individual animal will have a zero probability of capture. In single species camera trap surveys this is straight forward and the distance between the traps must be decided by considering the minimum home range of the species under consideration. However, in multi species camera trap surveys, the species that is known to have the smallest home range should be considered. Although in the majority of the studies in the literature, the camera spacing between the camera trap locations are around 1 to 2 kilometres, the choice of distance between two camera trap locations varies among the published studies (Larrucea *et al.,* 2007). It is important to note that the camera trapping methodology is currently developing and there are not established methodologies and standards but recommendations for even species such as tigers, ocelots which have been the focus of several camera trapping studies published so far. In evaluation of the studies, in a recent one (Tobler *et al.,* 2008) it is mentioned that the distance between the camera trap locations may have little impact on the detection of species in surveys conducted for species inventories.

Present study suggests that in forest habitats similar to Yaylacık Research Forest, each phase of a camera trap survey targeting wolf, wildcat, pine marten and roe deer might be planned for less than 15 days and may be for 11 days. It is advisable to conduct the surveys for brown bear, red fox and wild boar longer than 15 days perhaps within the range of 15-20 days. Brown bear activity is highly associated with severity of winter and bears hibernate depending on the availability of food sources and the winter conditions, therefore future multi species camera trapping studies should consider the season effect on the temporal and spatial activity of brown bears.

CHAPTER 5

CONCLUSIONS

1. This study used camera traps and provided detailed baseline data on wolf, brown bear, wildcat, roe deer, and wild boar in Yenice Forest, a globally important mammal region and one of the largest intact forest habitats in Turkey.

   Seventy six point five percent of the entire camera trap records collected during the present study was suitable for further analysis yielding a higher efficiency in gathering camera trap data compared to previous studies reported in literature. The high percentage of suitable records was attributed to the field experience of the team (the author and the forestry staff) which is an important factor in wildlife studies.

   The local knowledge about the presence of wildlife should be considered but local information cannot replace the necessity of conducting accurate field surveys by trained biologists. Camera trapping surveys can detect species that are undetected by other ground survey methods. Again this study indicated that local information should be verified by researchers and wildlife managers on the ground before incorporating them into various management and conservation decisions.

   The following activity patterns were observed: although the wolf is generally considered to be active only during nocturnal periods, they were observed to be crepuscular in the study area. Similarly, the wildcat is known to be crepuscular or nocturnal but it also showed a diurnal activity pattern in this study.

Wildcat was observed to avoid wolf and red fox at temporal and spatial scales. This study provided new examples suggesting that temporal and spatial activity patterns of large mammals can be documented by using camera trapping methodology.

Regional diversity patterns of large mammals can be studied comparatively by the use of camera trapping data using statistical methods to identify high biodiversity centres for large mammals. This approach can also be utilized to identify potential sites for wildlife conservation during various stages of forestry activities.

2. Simulation studies indicated that each phase of camera trapping surveys that will be conducted in habitats similar to Yaylacık Research Forest should last at least 14 days for wolf, 13 days for wildcat, 10 days for pine marten, and 11 days for roe deer. It is advisable to conduct longer surveys, probably 15-20 days for wild boar, red fox and brown bears in similar forest habitats.

3. Encounter rates, if obtained after sufficient period of observation time, can be used to monitor the seasonal activity of large mammals in a given area. Encounter rates can also be used to develop a crude understanding of relative abundance of target species in an area. The wolf was found to be the least abundant species where as wild boar was the most abundant species in the study area when encounter rates were considered. In camera trap surveys targeting multiple species, the camera trap sampling approach should be adjusted to reflect the species with the smallest home range. Otherwise, the population size estimation cannot be done for the species that can be individually identified. Because the distances between the camera traps were appropriate in this study, it was possible to estimate the size of wildcat population.

4. Camera trapping methodology was used to estimate population sizes of wildcats in study area. The estimated population size for wildcat was 9 (SE=2.28227) with 95% confidence interval of 9 to 25 in the study area. Camera trapping methodology can also be used to gather data on brown bears and conservative estimates can be made given that the individuals have certain individual marks that can be distinguished from photographs. The conservative estimate for the number of brown bears utilizing the study area was a minimum of 6 individuals.

5. None of the camera traps used in this present study received any damage and none were stolen. However, the risk of theft and vandalism should be considered when designing a camera trap study.

6. A small team worked to conduct the 5 phase camera trap survey. However, when the initial cost of the purchase of the camera traps were not considered, the study produced detailed data on large mammal occurrence in the study area for a relatively low cost. Camera trapping technique results in a quantitative, non-invasive method with low labor costs. It is robust to various field conditions in difficult terrains where other field methods may fail to produce useful data.

7. Camera trapping has the potential to be a major tool for future field surveys and monitoring programs for large mammals in forested habitats in Turkey. Camera trapping can be widely used by the national wildlife authorities in Turkey after conducting relevant capacity building programs.

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APPENDIX A

EXAMPLES OF STANDARD FORMS USED

CAMERA TRAP STATION INFORMATION FORM

Camera Trap Station (CamTrapStat) No:

A. Camera trap 1 code:	**A. Camera trap 2 code:**
B. Date/hour of set:	**B. Date/hour of set:**
C. Date/hour of take off:	**C. Date/hour of take off:**
C. GPS coordinates:	**C. GPS coordinates:**
D. Height ASL:	**D. Height ASL:**
E. Sensor height from ground:	**E. Sensor height from ground:**
H. Film code:	**H. Film code:**
J. Starting / final frame number:	**J. Starting / final frame number:**

Camera Check List
1. Switches ?
2. C batteries ?
3. Other batteries ?
4. Date ?
5. Hour ?
6. Padlocks ?
7. Information card ?
8. Infrared (red light) ?
9. Infrared (green light) ?
10. Led cover ?
11. Camouflage secure?
12. Test shot ?

Camera Check List
1. Switches ?
2. C batteries ?
3. Other batteries ?
4. Date ?
5. Hour ?
6. Padlocks ?
7. Information card ?
8. Infrared (red light) ?
9. Infrared (green light) ?
10. Led cover ?
11. Camouflage secure?
12. Test shot ?

Diagram of the location:

B: Bottomland
D: Intermittent drainage way
F: Footslope
T: Terrace
U: Upland

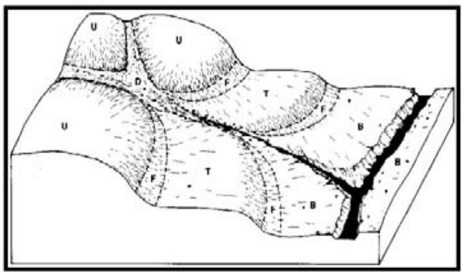

Figure A1. Camera trap station information form.

TRANSECT INFORMATION FORM

Date:

Transect start hour: **Transect finish hour:**

Duration of the walk: **Length of the transect:**

Ground type: snow / mud / leafy / soil / rock / water

Weather type: rainy / snowy / fogy / sunny / cloudy / easy

Carnivores sighted:	**Herbivores sighted:**
Wolf:	Wild boar:
Bear:	Roe deer:
Fox:	Red deer:
Marten:	Hare:
Lynx:	……….
Badger:	
…………	**Herbivore tracks encountered:**
Carnivore tracks encountered:	Wild boar:
Wolf:	Roe deer:
Bear:	Red deer:
Fox:	Hare:
Marten:	……….
Lynx:	
Badger:	**Herbivore scats encountered:**
…………	Wild boar:
Carnivore scats encountered:	Roe deer:
Wolf:	Red deer:
Bear:	Hare:
Fox:	……….
Marten:	
Lynx:	
Badger:	
……….	

Figure A2. Transect information form.

CAMERA TRAP STATION RECORDS

CamTrapStat No: Camera No: Camera Code: Film Code:

Insert picture here!

Film frame no: **Record Date/hour:** **Species:**

Insert picture here!

Film frame no: **Record Date/hour:** **Species:**

Figure A3. Camera trap station records form.

APPENDIX B

EXAMPLES OF CAMERA TRAP RECORDS

Figure B1. Brown bears.

Figure B2. Wolves.

Figure B3. Wildcats.

Figure B4. Red foxes.

Figure B5. Pine martens.

Figure B6. Roe deer.

Figure B7. Wild boar.

APPENDIX C

CAMERA TRAP LOG

Table C.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
1	1	26-02-06	12-03-06	1	-	-
1	1	26-02-06	12-03-06	2	-	-
1	1	26-02-06	12-03-06	3	-	-
1	1	26-02-06	12-03-06	4	-	-
1	1	26-02-06	12-03-06	5	-	-
1	1	26-02-06	12-03-06	6	-	-
1	1	26-02-06	12-03-06	7	-	-
1	1	26-02-06	12-03-06	8	-	-
1	1	26-02-06	12-03-06	9	-	-
1	1	26-02-06	12-03-06	10	-	-
1	1	26-02-06	12-03-06	11	-	-
1	1	26-02-06	12-03-06	12	-	-
1	1	26-02-06	12-03-06	13	-	-
1	1	26-02-06	12-03-06	14	-	-
1	1	26-02-06	12-03-06	15	-	-
1	2	26-02-06	12-03-06	1	-	-
1	2	26-02-06	12-03-06	2	-	-
1	2	26-02-06	12-03-06	3	-	-
1	2	26-02-06	12-03-06	4	-	-
1	2	26-02-06	12-03-06	5	-	-
1	2	26-02-06	12-03-06	6	-	-
1	2	26-02-06	12-03-06	7	-	-
1	2	26-02-06	12-03-06	8	-	-
1	2	26-02-06	12-03-06	9	-	-
1	2	26-02-06	12-03-06	10	-	-
1	2	26-02-06	12-03-06	11	-	-
1	2	26-02-06	12-03-06	12	-	-
1	2	26-02-06	12-03-06	13	-	-
1	2	26-02-06	12-03-06	14	-	-
1	2	26-02-06	12-03-06	15	-	-
2	3	26-02-06	12-03-06	1	-	-
2	3	26-02-06	12-03-06	2	-	-
2	3	26-02-06	12-03-06	3	-	-
2	3	26-02-06	12-03-06	4	-	-
2	3	26-02-06	12-03-06	5	-	-

No records between the 6th and 15th days.

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
2	3	26-02-06	12-03-06	12	-	-
2	3	26-02-06	12-03-06	13	-	-
2	3	26-02-06	12-03-06	14	-	-
2	3	26-02-06	12-03-06	15	-	-
2	4	26-02-06	12-03-06	1	-	-
2	4	26-02-06	12-03-06	2	-	-
2	4	26-02-06	12-03-06	3	-	-
2	4	26-02-06	12-03-06	4	-	-
2	4	26-02-06	12-03-06	5	-	-
2	4	26-02-06	12-03-06	6	-	-
2	4	26-02-06	12-03-06	7	-	-
2	4	26-02-06	12-03-06	8	-	-
2	4	26-02-06	12-03-06	9	-	-
2	4	26-02-06	12-03-06	10	-	-
2	4	26-02-06	12-03-06	11	-	-
2	4	26-02-06	12-03-06	12	-	-
2	4	26-02-06	12-03-06	13	-	-
2	4	26-02-06	12-03-06	14	-	-
2	4	26-02-06	12-03-06	15	-	-
3	5	26-02-06	12-03-06	1	-	-
3	5	26-02-06	12-03-06	2	-	-
3	5	26-02-06	12-03-06	3	-	-
3	5	26-02-06	12-03-06	4	-	-
3	5	26-02-06	12-03-06	5	15:47	Unknown
3	5	26-02-06	12-03-06	6	-	-
3	5	26-02-06	12-03-06	7	-	-
3	5	26-02-06	12-03-06	8	-	-
3	5	26-02-06	12-03-06	9	-	-
3	5	26-02-06	12-03-06	10	-	-
3	5	26-02-06	12-03-06	11	-	-
3	5	26-02-06	12-03-06	12	-	-
3	5	26-02-06	12-03-06	13	-	-
3	5	26-02-06	12-03-06	14	-	-
3	5	26-02-06	12-03-06	15	-	-
3	6	26-02-06	12-03-06	1	16:07	Unknown
3	6	26-02-06	12-03-06	2	-	-
3	6	26-02-06	12-03-06	3	-	-
3	6	26-02-06	12-03-06	4	-	-
3	6	26-02-06	12-03-06	5	-	-
3	6	26-02-06	12-03-06	6	-	-
3	6	26-02-06	12-03-06	7	-	-
3	6	26-02-06	12-03-06	8	-	-
3	6	26-02-06	12-03-06	9	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
3	6	26-02-06	12-03-06	11	-	-
3	6	26-02-06	12-03-06	12	-	-
3	6	26-02-06	12-03-06	13	-	-
3	6	26-02-06	12-03-06	14	-	-
3	6	26-02-06	12-03-06	15	-	-
4	7	26-02-06	12-03-06	1	-	-
4	7	26-02-06	12-03-06	2	-	-
4	7	26-02-06	12-03-06	3	-	-
4	7	26-02-06	12-03-06	4	-	-
4	7	26-02-06	12-03-06	5	-	-
4	7	26-02-06	12-03-06	6	-	-
4	7	26-02-06	12-03-06	7	-	-
4	7	26-02-06	12-03-06	8	-	-
4	7	26-02-06	12-03-06	9	-	-
4	7	26-02-06	12-03-06	10	-	-
4	7	26-02-06	12-03-06	11	0:33	Badger
4	7	26-02-06	12-03-06	12	-	-
4	7	26-02-06	12-03-06	13	-	-
4	7	26-02-06	12-03-06	14	-	-
4	7	26-02-06	12-03-06	15	-	-
4	8	26-02-06	12-03-06	1	-	-
4	8	26-02-06	12-03-06	2	-	-
4	8	26-02-06	12-03-06	3	-	-
4	8	26-02-06	12-03-06	4	-	-
4	8	26-02-06	12-03-06	5	-	-
4	8	26-02-06	12-03-06	6	-	-
4	8	26-02-06	12-03-06	7	-	-
4	8	26-02-06	12-03-06	8	-	-
4	8	26-02-06	12-03-06	9	-	-
4	8	26-02-06	12-03-06	10	-	-
4	8	26-02-06	12-03-06	11	-	-
4	8	26-02-06	12-03-06	12	-	-
4	8	26-02-06	12-03-06	13	-	-
4	8	26-02-06	12-03-06	14	-	-
4	8	26-02-06	12-03-06	15	-	-
5	9	26-02-06	12-03-06	1	-	-
5	9	26-02-06	12-03-06	2	-	-
5	9	26-02-06	12-03-06	3	-	-
5	9	26-02-06	12-03-06	4	-	-
5	9	26-02-06	12-03-06	5	21:16	Roe deer
5	9	26-02-06	12-03-06	6	-	-
5	9	26-02-06	12-03-06	7	-	-
5	9	26-02-06	12-03-06	8	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
5	9	26-02-06	12-03-06	9	-	-
5	9	26-02-06	12-03-06	10	-	-
5	9	26-02-06	12-03-06	11	-	-
5	9	26-02-06	12-03-06	12	8:03	Roe deer
5	9	26-02-06	12-03-06	13	-	-
5	9	26-02-06	12-03-06	14	-	-
5	9	26-02-06	12-03-06	15	-	-
5	10	26-02-06	12-03-06	1	-	-
5	10	26-02-06	12-03-06	2	-	-
5	10	26-02-06	12-03-06	3	-	-
5	10	26-02-06	12-03-06	4	-	-
5	10	26-02-06	12-03-06	5	-	-
5	10	26-02-06	12-03-06	6	-	-
5	10	26-02-06	12-03-06	7	-	-
5	10	26-02-06	12-03-06	8	-	-
5	10	26-02-06	12-03-06	9	-	-
5	10	26-02-06	12-03-06	10	-	-
5	10	26-02-06	12-03-06	11	-	-
5	10	26-02-06	12-03-06	12	-	-
5	10	26-02-06	12-03-06	13	-	-
5	10	26-02-06	12-03-06	14	-	-
5	10	26-02-06	12-03-06	15	20:59	Roe deer
6	11	26-02-06	12-03-06	1	-	-
6	11	26-02-06	12-03-06	2	-	-
6	11	26-02-06	12-03-06	3	2:57	Unknown
6	11	26-02-06	12-03-06	4	-	-
6	11	26-02-06	12-03-06	5	-	-
6	11	26-02-06	12-03-06	6	-	-
6	11	26-02-06	12-03-06	7	-	-
6	11	26-02-06	12-03-06	8	-	-
6	11	26-02-06	12-03-06	9	-	-
6	11	26-02-06	12-03-06	10	-	-
6	11	26-02-06	12-03-06	11	-	-
6	11	26-02-06	12-03-06	12	-	-
6	11	26-02-06	12-03-06	13	-	-
6	11	26-02-06	12-03-06	14	-	-
6	11	26-02-06	12-03-06	15	-	-
6	12	26-02-06	12-03-06	1	-	-
6	12	26-02-06	12-03-06	2	-	-
6	12	26-02-06	12-03-06	3	-	-
6	12	26-02-06	12-03-06	7	0:10	Pine marten
6	12	26-02-06	12-03-06	8	-	-
6	12	26-02-06	12-03-06	9	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
6	12	26-02-06	12-03-06	10	-	-
6	12	26-02-06	12-03-06	11	-	-
6	12	26-02-06	12-03-06	12	-	-
6	12	26-02-06	12-03-06	13	-	-
6	12	26-02-06	12-03-06	14	-	-
6	12	26-02-06	12-03-06	15	-	-
7	13	27-02-06	13-03-06	1	-	-
7	13	27-02-06	13-03-06	2	-	-
7	13	27-02-06	13-03-06	3	10:10	Wildcat
7	13	27-02-06	13-03-06	3	10:29	Wildcat
7	13	27-02-06	13-03-06	3	14:35	Wildcat
7	13	27-02-06	13-03-06	3	10:29	Unknown
7	13	27-02-06	13-03-06	4	2:17	Wildcat
7	13	27-02-06	13-03-06	4	16:53	Wild boar group
7	13	27-02-06	13-03-06	4	18:49	Unknown
7	13	27-02-06	13-03-06	4	10:24	Unknown
7	13	27-02-06	13-03-06	5	4:02	Wildcat
7	13	27-02-06	13-03-06	5	19:17	Unknown
7	13	27-02-06	13-03-06	6	20:09	Wildcat
7	13	27-02-06	13-03-06	7	18:01	Wild boar group
7	13	27-02-06	13-03-06	8	-	-
7	13	27-02-06	13-03-06	9	16:31	Unknown
7	13	27-02-06	13-03-06	10	14:17	Wildcat
7	13	27-02-06	13-03-06	10	14:38	Unknown
7	13	27-02-06	13-03-06	11	-	-
7	13	27-02-06	13-03-06	12	-	-
7	13	27-02-06	13-03-06	13	-	-
7	13	27-02-06	13-03-06	14	-	-
7	13	27-02-06	13-03-06	15	18:52	Wild boar group
7	13	27-02-06	13-03-06	15	18:54	Wild boar
7	13	27-02-06	13-03-06	15	19:25	Wild boar
7	14	27-02-06	13-03-06	1	14:11	Unknown
7	14	27-02-06	13-03-06	1	19:45	Wild boar
7	14	27-02-06	13-03-06	2	-	-
7	14	27-02-06	13-03-06	3	10:01	Wildcat
7	14	27-02-06	13-03-06	3	10:18	Wildcat
7	14	27-02-06	13-03-06	3	10:27	Wildcat
7	14	27-02-06	13-03-06	3	15:04	Wildcat
7	14	27-02-06	13-03-06	4	16:52	Wild boar group
7	14	27-02-06	13-03-06	5	19:17	Unknown
7	14	27-02-06	13-03-06	6	20:09	Wildcat
7	14	27-02-06	13-03-06	7	8:50	Unknown
7	14	27-02-06	13-03-06	7	19:01	Wild boar group

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
7	14	27-02-06	13-03-06	8	-	-
7	14	27-02-06	13-03-06	9	-	-
7	14	27-02-06	13-03-06	10	-	-
7	14	27-02-06	13-03-06	11	-	-
7	14	27-02-06	13-03-06	12	21:39	Pine marten
7	14	27-02-06	13-03-06	13	-	-
7	14	27-02-06	13-03-06	14	-	-
7	14	27-02-06	13-03-06	15	19:25	Wild boar
8	15	27-02-06	13-03-06	1	-	-
8	15	27-02-06	13-03-06	2	-	-
8	15	27-02-06	13-03-06	3	-	-
8	15	27-02-06	13-03-06	4	-	-
8	15	27-02-06	13-03-06	5	-	-
8	15	27-02-06	13-03-06	6	-	-
8	15	27-02-06	13-03-06	7	-	-
8	15	27-02-06	13-03-06	8	-	-
8	15	27-02-06	13-03-06	9	0:30	Wild boar group
8	15	27-02-06	13-03-06	9	3:45	Wild boar
8	15	27-02-06	13-03-06	10	-	-
8	15	27-02-06	13-03-06	11	-	-
8	15	27-02-06	13-03-06	12	-	-
8	15	27-02-06	13-03-06	13	-	-
8	15	27-02-06	13-03-06	14	-	-
8	15	27-02-06	13-03-06	15	-	-
8	16	27-02-06	13-03-06	1	-	-
8	16	27-02-06	13-03-06	2	-	-
8	16	27-02-06	13-03-06	3	2:00	Wild boar group
8	16	27-02-06	13-03-06	4	-	-
8	16	27-02-06	13-03-06	5	-	-
8	16	27-02-06	13-03-06	6	3:00	Wildcat
8	16	27-02-06	13-03-06	7	-	-
8	16	27-02-06	13-03-06	8	-	-
8	16	27-02-06	13-03-06	9	-	-
8	16	27-02-06	13-03-06	9	-	-
8	16	27-02-06	13-03-06	10	-	-
8	16	27-02-06	13-03-06	11	-	-
8	16	27-02-06	13-03-06	12	-	-
8	16	27-02-06	13-03-06	13	-	-
8	16	27-02-06	13-03-06	14	-	-
8	16	27-02-06	13-03-06	15	-	-
9	17	16-03-06	30-03-06	1	-	-
9	17	16-03-06	30-03-06	2	-	-
9	17	16-03-06	30-03-06	3	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
9	17	16-03-06	30-03-06	4	-	-
9	17	16-03-06	30-03-06	5	-	-
9	17	16-03-06	30-03-06	6	-	-
9	17	16-03-06	30-03-06	7	-	-
9	17	16-03-06	30-03-06	8	-	-
9	17	16-03-06	30-03-06	9	-	-
9	17	16-03-06	30-03-06	10	-	-
9	17	16-03-06	30-03-06	11	19:48	Wild boar
9	17	16-03-06	30-03-06	12	-	-
9	17	16-03-06	30-03-06	13	-	-
9	17	16-03-06	30-03-06	14	-	-
9	17	16-03-06	30-03-06	15	-	-
9	18	16-03-06	30-03-06	1	-	-
9	18	16-03-06	30-03-06	2	-	-
9	18	16-03-06	30-03-06	3	-	-
9	18	16-03-06	30-03-06	4	-	-
9	18	16-03-06	30-03-06	5	21:37	Red fox
9	18	16-03-06	30-03-06	6	19:17	Pine marten
9	18	16-03-06	30-03-06	6	2:43	Pine marten
9	18	16-03-06	30-03-06	6	3:59	Pine marten
9	18	16-03-06	30-03-06	8	16:27	Wild boar
9	18	16-03-06	30-03-06	9	-	-
9	18	16-03-06	30-03-06	10	-	-
9	18	16-03-06	30-03-06	11	-	-
9	18	16-03-06	30-03-06	12	-	-
9	18	16-03-06	30-03-06	13	-	-
9	18	16-03-06	30-03-06	14	-	-
9	18	16-03-06	30-03-06	15	3:16	Red fox
10	19	16-03-06	30-03-06	1	-	-
10	19	16-03-06	30-03-06	2	22:11	Wild boar
10	19	16-03-06	30-03-06	3	-	-
10	19	16-03-06	30-03-06	4	-	-
10	19	16-03-06	30-03-06	5	-	-
10	19	16-03-06	30-03-06	6	-	-
10	19	16-03-06	30-03-06	7	-	-
10	19	16-03-06	30-03-06	8	-	-
10	19	16-03-06	30-03-06	9	-	-
10	19	16-03-06	30-03-06	10	-	-
10	19	16-03-06	30-03-06	11	-	-
10	19	16-03-06	30-03-06	12	-	-
10	19	16-03-06	30-03-06	13	-	-
10	19	16-03-06	30-03-06	14	-	-
10	19	16-03-06	30-03-06	15	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
10	20	16-03-06	30-03-06	1	-	-
10	20	16-03-06	30-03-06	3	-	-
10	20	16-03-06	30-03-06	4	-	-
10	20	16-03-06	30-03-06	5	-	-
10	20	16-03-06	30-03-06	6	-	-
10	20	16-03-06	30-03-06	7	-	-
10	20	16-03-06	30-03-06	8	-	-
10	20	16-03-06	30-03-06	9	-	-
10	20	16-03-06	30-03-06	10	-	-
10	20	16-03-06	30-03-06	11	18:26	Wild boar
10	20	16-03-06	30-03-06	12	-	-
10	20	16-03-06	30-03-06	13	-	-
10	20	16-03-06	30-03-06	14	-	-
10	20	16-03-06	30-03-06	15	-	-
11	21	16-03-06	30-03-06	1	-	-
11	21	16-03-06	30-03-06	2	-	-
11	21	16-03-06	30-03-06	3	-	-
11	21	16-03-06	30-03-06	4	1:03	Unknown
11	21	16-03-06	30-03-06	5	18:22	Wild boar group
11	21	16-03-06	30-03-06	5	0:27	Wild boar group
11	21	16-03-06	30-03-06	6	-	-
11	21	16-03-06	30-03-06	7	18:51	Wild boar group
11	21	16-03-06	30-03-06	7	19:06	Unknown
11	21	16-03-06	30-03-06	7	19:10	Wild boar
11	21	16-03-06	30-03-06	8	4:18	Wild boar
11	21	16-03-06	30-03-06	8	18:58	Wild boar
11	21	16-03-06	30-03-06	8	0:29	Wild boar
11	21	16-03-06	30-03-06	9	5:47	Wild boar
11	21	16-03-06	30-03-06	10	3:39	Wild boar
11	21	16-03-06	30-03-06	11	0:07	Unknown
11	21	16-03-06	30-03-06	11	20:48	Wild boar
11	21	16-03-06	30-03-06	11	21:37	Wild boar group
11	21	16-03-06	30-03-06	11	21:39	Wild boar
11	21	16-03-06	30-03-06	12	23:12	Wild boar
11	21	16-03-06	30-03-06	13	3:06	Wild boar
11	21	16-03-06	30-03-06	14	5:15	Wild boar
11	21	16-03-06	30-03-06	14	18:00	Wolf
11	21	16-03-06	30-03-06	14	20:14	Wild boar
11	21	16-03-06	30-03-06	15	-	-
11	22	16-03-06	30-03-06	1	23:15	Red fox
11	22	16-03-06	30-03-06	2	-	-
11	22	16-03-06	30-03-06	3	18:22	Unknown
11	22	16-03-06	30-03-06	5	0:27	Wild boar group

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
11	22	16-03-06	30-03-06	5	18:21	Wild boar group
11	22	16-03-06	30-03-06	5	23:42	Wild boar group
11	22	16-03-06	30-03-06	6	22:25	Wild boar (M)
11	22	16-03-06	30-03-06	7	18:50	Wild boar
11	22	16-03-06	30-03-06	7	19:02	Wild boar
11	22	16-03-06	30-03-06	7	3:46	Wild boar
11	22	16-03-06	30-03-06	7	18:51	Wild boar group
11	22	16-03-06	30-03-06	7	19:05	Wild boar
11	22	16-03-06	30-03-06	7	21:49	Red fox
11	22	16-03-06	30-03-06	8	4:17	Wild boar (M)
11	22	16-03-06	30-03-06	8	15:33	Wild boar
11	22	16-03-06	30-03-06	8	18:57	Wild boar
11	22	16-03-06	30-03-06	9	5:46	Wild boar
11	22	16-03-06	30-03-06	10	-	-
11	22	16-03-06	30-03-06	11	0:06	Wild boar group
11	22	16-03-06	30-03-06	11	11:19	Wild boar group
11	22	16-03-06	30-03-06	11	20:47	Wild boar
11	22	16-03-06	30-03-06	11	21:38	Wild boar group
11	22	16-03-06	30-03-06	12	13:11	Wild boar
11	22	16-03-06	30-03-06	13	0:00	Wild boar
11	22	16-03-06	30-03-06	13	3:05	Wild boar
11	22	16-03-06	30-03-06	14	5:14	Wild boar
11	22	16-03-06	30-03-06	14	20:13	Wild boar
11	22	16-03-06	30-03-06	15	3:58	Wild boar
11	22	16-03-06	30-03-06	15	12:36	Wild boar
12	23	16-03-06	30-03-06	1	-	-
12	23	16-03-06	30-03-06	2	-	-
12	23	16-03-06	30-03-06	3	-	-
12	23	16-03-06	30-03-06	4	-	-
12	23	16-03-06	30-03-06	5	22:37	Wild boar
12	23	16-03-06	30-03-06	5	22:56	Wild boar
12	23	16-03-06	30-03-06	6	2:04	Wolf
12	23	16-03-06	30-03-06	7	-	-
12	23	16-03-06	30-03-06	8	-	-
12	23	16-03-06	30-03-06	9	2:30	Wildcat
12	23	16-03-06	30-03-06	10	-	-
12	23	16-03-06	30-03-06	11	-	-
12	23	16-03-06	30-03-06	12	23:38	Wild boar
12	23	16-03-06	30-03-06	13	1:10	Red fox
12	23	16-03-06	30-03-06	14	-	-
12	23	16-03-06	30-03-06	15	-	-
12	24	16-03-06	30-03-06	1	-	-
12	24	16-03-06	30-03-06	2	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
12	24	16-03-06	30-03-06	3	-	-
12	24	16-03-06	30-03-06	4	-	-
12	24	16-03-06	30-03-06	5	-	-
12	24	16-03-06	30-03-06	6	-	-
12	24	16-03-06	30-03-06	7	-	-
12	24	16-03-06	30-03-06	8	-	-
12	24	16-03-06	30-03-06	9	-	-
12	24	16-03-06	30-03-06	10	-	-
12	24	16-03-06	30-03-06	11	-	-
12	24	16-03-06	30-03-06	12	-	-
12	24	16-03-06	30-03-06	13	-	-
12	24	16-03-06	30-03-06	14	-	-
12	24	16-03-06	30-03-06	15	-	-
13	25	17-03-06	31-03-06	1	-	-
13	25	17-03-06	31-03-06	2	-	-
13	25	17-03-06	31-03-06	3	-	-
13	25	17-03-06	31-03-06	4	-	-
13	25	17-03-06	31-03-06	5	-	-
13	25	17-03-06	31-03-06	6	17:34	Wild boar
13	25	17-03-06	31-03-06	7	-	-
13	25	17-03-06	31-03-06	8	-	-
13	25	17-03-06	31-03-06	9	-	-
13	25	17-03-06	31-03-06	10	-	-
13	25	17-03-06	31-03-06	11	-	-
13	25	17-03-06	31-03-06	12	-	-
13	25	17-03-06	31-03-06	13	-	-
13	25	17-03-06	31-03-06	14	-	-
13	25	17-03-06	31-03-06	15	-	-
13	26	17-03-06	31-03-06	1	-	-
13	26	17-03-06	31-03-06	2	-	-
13	26	17-03-06	31-03-06	3	-	-
13	26	17-03-06	31-03-06	4	-	-
13	26	17-03-06	31-03-06	5	-	-
13	26	17-03-06	31-03-06	6	-	-
13	26	17-03-06	31-03-06	7	-	-
13	26	17-03-06	31-03-06	8	-	-
13	26	17-03-06	31-03-06	9	-	-
13	26	17-03-06	31-03-06	10	-	-
13	26	17-03-06	31-03-06	11	-	-
13	26	17-03-06	31-03-06	12	-	-
13	26	17-03-06	31-03-06	13	-	-
13	26	17-03-06	31-03-06	14	-	-
13	26	17-03-06	31-03-06	15	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
14	27	17-03-06	31-03-06	1	-	-
14	27	17-03-06	31-03-06	2	18:39	Wild boar (M)
14	27	17-03-06	31-03-06	2	19:10	Unknown
14	27	17-03-06	31-03-06	2	22:41	Wild boar
14	27	17-03-06	31-03-06	3	-	-
14	27	17-03-06	31-03-06	4	17:29	Roe deer
14	27	17-03-06	31-03-06	4	18:52	Red fox
14	27	17-03-06	31-03-06	5	7:13	Unknown
14	27	17-03-06	31-03-06	6	23:02	Wild boar
14	27	17-03-06	31-03-06	7	-	-
14	27	17-03-06	31-03-06	8	0:43	Wildcat
14	27	17-03-06	31-03-06	9	-	-
14	27	17-03-06	31-03-06	11	-	-
14	27	17-03-06	31-03-06	12	18:40	Red fox
14	27	17-03-06	31-03-06	13	19:24	Red fox
14	27	17-03-06	31-03-06	14	4:40	Red fox
14	27	17-03-06	31-03-06	14	12:05	Wildcat
14	27	17-03-06	31-03-06	14	17:19	Wild boar group
14	27	17-03-06	31-03-06	14	19:22	Wild boar group
14	27	17-03-06	31-03-06	14	20:08	Wild boar
14	27	17-03-06	31-03-06	15	-	-
14	28	17-03-06	31-03-06	1	-	-
14	28	17-03-06	31-03-06	2	-	-
14	28	17-03-06	31-03-06	3	-	-
14	28	17-03-06	31-03-06	4	17:24	Roe deer
14	28	17-03-06	31-03-06	5	-	-
14	28	17-03-06	31-03-06	6	-	-
14	28	17-03-06	31-03-06	7	-	-
14	28	17-03-06	31-03-06	8	-	-
14	28	17-03-06	31-03-06	9	-	-
14	28	17-03-06	31-03-06	10	-	-
14	28	17-03-06	31-03-06	11	-	-
14	28	17-03-06	31-03-06	12	-	-
14	28	17-03-06	31-03-06	13	-	-
14	28	17-03-06	31-03-06	14	17:14	Wild boar group
14	28	17-03-06	31-03-06	14	19:25	Wild boar
14	28	17-03-06	31-03-06	15	-	-
15	29	17-03-06	31-03-06	1	-	-
15	29	17-03-06	31-03-06	2	-	-
15	29	17-03-06	31-03-06	3	-	-
15	29	17-03-06	31-03-06	4	-	-
15	29	17-03-06	31-03-06	5	-	-
15	29	17-03-06	31-03-06	6	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
15	29	17-03-06	31-03-06	7	-	-
15	29	17-03-06	31-03-06	8	-	-
15	29	17-03-06	31-03-06	9	-	-
15	29	17-03-06	31-03-06	10	-	-
15	29	17-03-06	31-03-06	11	-	-
15	29	17-03-06	31-03-06	12	-	-
15	29	17-03-06	31-03-06	13	-	-
15	29	17-03-06	31-03-06	14	19:43	Wild boar
15	29	17-03-06	31-03-06	15	-	-
15	30	17-03-06	31-03-06	1	-	-
15	30	17-03-06	31-03-06	2	4:00	Red fox
15	30	17-03-06	31-03-06	3	-	-
15	30	17-03-06	31-03-06	4	22:46	Red fox
15	30	17-03-06	31-03-06	5	-	-
15	30	17-03-06	31-03-06	6	20:25	Red fox
15	30	17-03-06	31-03-06	7	2:27	Red fox
15	30	17-03-06	31-03-06	8	-	-
15	30	17-03-06	31-03-06	9	-	-
15	30	17-03-06	31-03-06	10	22:32	Red fox
15	30	17-03-06	31-03-06	10	2:05	Red fox
15	30	17-03-06	31-03-06	11	21:49	Wildcat
15	30	17-03-06	31-03-06	12	-	-
15	30	17-03-06	31-03-06	13	-	-
15	30	17-03-06	31-03-06	14	19:44	Wild boar
15	30	17-03-06	31-03-06	15	3:16	Badger
16	31	17-03-06	31-03-06	1	-	-
16	31	17-03-06	31-03-06	2	-	-
16	31	17-03-06	31-03-06	3	-	-
16	31	17-03-06	31-03-06	4	-	-
16	31	17-03-06	31-03-06	5	18:52	Wild boar
16	31	17-03-06	31-03-06	6	-	-
16	31	17-03-06	31-03-06	7	-	-
16	31	17-03-06	31-03-06	8	2:17	Wild boar group
16	31	17-03-06	31-03-06	9	-	-
16	31	17-03-06	31-03-06	10	-	-
16	31	17-03-06	31-03-06	11	-	-
16	31	17-03-06	31-03-06	12	-	-
16	31	17-03-06	31-03-06	13	-	-
16	31	17-03-06	31-03-06	14	-	-
16	31	17-03-06	31-03-06	15	-	-
16	32	17-03-06	31-03-06	1	-	-
16	32	17-03-06	31-03-06	2	-	-
16	32	17-03-06	31-03-06	3	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
16	32	17-03-06	31-03-06	4	-	-
16	32	17-03-06	31-03-06	5	18:21	Wild boar
16	32	17-03-06	31-03-06	6	0:04	Red fox
16	32	17-03-06	31-03-06	7	-	-
16	32	17-03-06	31-03-06	8	21:46	Red fox
16	32	17-03-06	31-03-06	8	1:47	Wild boar
16	32	17-03-06	31-03-06	9	-	-
16	32	17-03-06	31-03-06	10	-	-
16	32	17-03-06	31-03-06	11	-	-
16	32	17-03-06	31-03-06	12	-	-
16	32	17-03-06	31-03-06	13	-	-
16	32	17-03-06	31-03-06	14	-	-
16	32	17-03-06	31-03-06	15	-	-
17	33	01-04-06	15-04-06	1	-	-
17	33	01-04-06	15-04-06	2	-	-
17	33	01-04-06	15-04-06	3	-	-
17	33	01-04-06	15-04-06	4	-	-
17	33	01-04-06	15-04-06	5	-	-
17	33	01-04-06	15-04-06	6	-	-
17	33	01-04-06	15-04-06	7	-	-
17	33	01-04-06	15-04-06	8	0:31	Red fox
17	33	01-04-06	15-04-06	9	-	-
17	33	01-04-06	15-04-06	10	-	-
17	33	01-04-06	15-04-06	11	-	-
17	33	01-04-06	15-04-06	12	-	-
17	33	01-04-06	15-04-06	13	-	-
17	33	01-04-06	15-04-06	14	6:24	Wildcat
17	33	01-04-06	15-04-06	15	-	-
17	34	01-04-06	15-04-06	1	-	-
17	34	01-04-06	15-04-06	2	-	-
17	34	01-04-06	15-04-06	3	-	-
17	34	01-04-06	15-04-06	4	-	-
17	34	01-04-06	15-04-06	5	-	-
17	34	01-04-06	15-04-06	6	-	-
17	34	01-04-06	15-04-06	7	19:05	Wild boar (M)
17	34	01-04-06	15-04-06	8	-	-
17	34	01-04-06	15-04-06	9	-	-
17	34	01-04-06	15-04-06	10	21:49	Unknown
17	34	01-04-06	15-04-06	11	-	-
17	34	01-04-06	15-04-06	12	-	-
17	34	01-04-06	15-04-06	13	-	-
17	34	01-04-06	15-04-06	14	-	-
17	34	01-04-06	15-04-06	15	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
18	35	01-04-06	15-04-06	1	15:40	Unknown
18	35	01-04-06	15-04-06	2	-	-
18	35	01-04-06	15-04-06	3	-	-
18	35	01-04-06	15-04-06	4	-	-
18	35	01-04-06	15-04-06	5	-	-
18	35	01-04-06	15-04-06	6	1:10	Pine marten
18	35	01-04-06	15-04-06	6	1:24	Pine marten
18	35	01-04-06	15-04-06	7	-	-
18	35	01-04-06	15-04-06	8	-	-
18	35	01-04-06	15-04-06	9	-	-
18	35	01-04-06	15-04-06	11	-	-
18	35	01-04-06	15-04-06	13	-	-
18	35	01-04-06	15-04-06	14	-	-
18	35	01-04-06	15-04-06	15	-	-
18	36	01-04-06	15-04-06	1	-	-
18	36	01-04-06	15-04-06	2	7:20	Unknown
18	36	01-04-06	15-04-06	2	7:22	Unknown
18	36	01-04-06	15-04-06	3	15:57	Unknown
18	36	01-04-06	15-04-06	4	23:29	Unknown
18	36	01-04-06	15-04-06	5	3:51	Badger
18	36	01-04-06	15-04-06	5	3:52	Badger
18	36	01-04-06	15-04-06	6	1:10	Pine marten
18	36	01-04-06	15-04-06	8	-	-
18	36	01-04-06	15-04-06	9	-	-
18	36	01-04-06	15-04-06	10	-	-
18	36	01-04-06	15-04-06	13	-	-
18	36	01-04-06	15-04-06	14	-	-
18	36	01-04-06	15-04-06	15	-	-
18	36	01-04-06	15-04-06	15	11:54	Unknown
18	36	01-04-06	15-04-06	14	11:53	Unknown
19	37	01-04-06	15-04-06	1	20:40	Wild boar
19	37	01-04-06	15-04-06	2	-	-
19	37	01-04-06	15-04-06	3	-	-
19	37	01-04-06	15-04-06	4	3:00	Unknown
19	37	01-04-06	15-04-06	5	-	-
19	37	01-04-06	15-04-06	6	-	-
19	37	01-04-06	15-04-06	7	-	-
19	37	01-04-06	15-04-06	8	4:33	Roe deer
19	37	01-04-06	15-04-06	9	-	-
19	37	01-04-06	15-04-06	10	-	-
19	37	01-04-06	15-04-06	11	-	-
19	37	01-04-06	15-04-06	12	-	-
19	37	01-04-06	15-04-06	13	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
19	37	01-04-06	15-04-06	14	-	-
19	37	01-04-06	15-04-06	15	-	-
19	38	01-04-06	15-04-06	1	-	-
19	38	01-04-06	15-04-06	2	-	-
19	38	01-04-06	15-04-06	3	-	-
19	38	01-04-06	15-04-06	4	-	-
19	38	01-04-06	15-04-06	5	-	-
19	38	01-04-06	15-04-06	6	-	-
19	38	01-04-06	15-04-06	7	-	-
19	38	01-04-06	15-04-06	8	9:10	Wild boar group
19	38	01-04-06	15-04-06	9	20:25	Unknown
19	38	01-04-06	15-04-06	10	-	-
19	38	01-04-06	15-04-06	11	-	-
19	38	01-04-06	15-04-06	12	-	-
19	38	01-04-06	15-04-06	13	-	-
19	38	01-04-06	15-04-06	14	-	-
19	38	01-04-06	15-04-06	15	-	-
20	39	01-04-06	15-04-06	1	-	-
20	39	01-04-06	15-04-06	2	-	-
20	39	01-04-06	15-04-06	3	-	-
20	39	01-04-06	15-04-06	4	-	-
20	39	01-04-06	15-04-06	5	-	-
20	39	01-04-06	15-04-06	6	-	-
20	39	01-04-06	15-04-06	7	-	-
20	39	01-04-06	15-04-06	8	-	-
20	39	01-04-06	15-04-06	9	-	-
20	39	01-04-06	15-04-06	10	-	-
20	39	01-04-06	15-04-06	11	-	-
20	39	01-04-06	15-04-06	12	-	-
20	39	01-04-06	15-04-06	13	-	-
20	39	01-04-06	15-04-06	14	-	-
20	39	01-04-06	15-04-06	15	-	-
20	40	01-04-06	15-04-06	1	-	-
20	40	01-04-06	15-04-06	2	-	-
20	40	01-04-06	15-04-06	3	-	-
20	40	01-04-06	15-04-06	4	-	-
20	40	01-04-06	15-04-06	5	-	-
20	40	01-04-06	15-04-06	6	-	-
20	40	01-04-06	15-04-06	7	-	-
20	40	01-04-06	15-04-06	8	-	-
20	40	01-04-06	15-04-06	9	-	-
20	40	01-04-06	15-04-06	10	-	-
20	40	01-04-06	15-04-06	11	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
20	40	01-04-06	15-04-06	12	-	-
20	40	01-04-06	15-04-06	13	-	-
20	40	01-04-06	15-04-06	14	-	-
20	40	01-04-06	15-04-06	15	-	-
21	41	02-04-06	16-04-06	1	-	-
21	41	02-04-06	16-04-06	2	-	-
21	41	02-04-06	16-04-06	3	-	-
21	41	02-04-06	16-04-06	4	-	-
21	41	02-04-06	16-04-06	5	-	-
21	41	02-04-06	16-04-06	6	-	-
21	41	02-04-06	16-04-06	7	-	-
21	41	02-04-06	16-04-06	8	-	-
21	41	02-04-06	16-04-06	9	-	-
21	41	02-04-06	16-04-06	10	-	-
21	41	02-04-06	16-04-06	11	-	-
21	41	02-04-06	16-04-06	12	-	-
21	41	02-04-06	16-04-06	13	-	-
21	41	02-04-06	16-04-06	14	-	-
21	41	02-04-06	16-04-06	15	-	-
21	41	02-04-06	16-04-06	15	6:22	Unknown
21	42	02-04-06	16-04-06	1	-	-
21	42	02-04-06	16-04-06	2	-	-
21	42	02-04-06	16-04-06	3	18:05	Unknown
21	42	02-04-06	16-04-06	4	-	-
21	42	02-04-06	16-04-06	5	-	-
21	42	02-04-06	16-04-06	6	-	-
21	42	02-04-06	16-04-06	7	-	-
21	42	02-04-06	16-04-06	8	-	-
21	42	02-04-06	16-04-06	9	-	-
21	42	02-04-06	16-04-06	10	7:56	Roe deer
21	42	02-04-06	16-04-06	10	7:57	Roe deer group
21	42	02-04-06	16-04-06	10	7:59	Roe deer
21	42	02-04-06	16-04-06	11	-	-
21	42	02-04-06	16-04-06	12	-	-
21	42	02-04-06	16-04-06	13	9:17	Roe deer
21	42	02-04-06	16-04-06	14	-	-
21	42	02-04-06	16-04-06	15	-	-
21	42	02-04-06	16-04-06	15	19:13	Brown bear
22	43	02-04-06	16-04-06	1	1:13	Wild boar
22	43	02-04-06	16-04-06	1	1:36	Red fox
22	43	02-04-06	16-04-06	1	1:56	Wild boar
22	43	02-04-06	16-04-06	1	2:02	Wild boar
22	43	02-04-06	16-04-06	2	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
22	43	02-04-06	16-04-06	3	-	-
22	43	02-04-06	16-04-06	4	-	-
22	43	02-04-06	16-04-06	5	-	-
22	43	02-04-06	16-04-06	6	-	-
22	43	02-04-06	16-04-06	7	-	-
22	43	02-04-06	16-04-06	8	0:32	Red fox
22	43	02-04-06	16-04-06	9	-	-
22	43	02-04-06	16-04-06	10	-	-
22	43	02-04-06	16-04-06	11	-	-
22	43	02-04-06	16-04-06	12	-	-
22	43	02-04-06	16-04-06	13	-	-
22	43	02-04-06	16-04-06	14	3:57	Wild boar group
22	43	02-04-06	16-04-06	14	4:01	Wild boar
22	43	02-04-06	16-04-06	14	4:33	Wild boar group
22	43	02-04-06	16-04-06	14	14:18	Red fox
22	43	02-04-06	16-04-06	15	-	-
22	43	02-04-06	16-04-06	13	3:31	Wild boar
22	43	02-04-06	16-04-06	14	0:41	Wild boar
22	44	02-04-06	16-04-06	1	-	-
22	44	02-04-06	16-04-06	2	-	-
22	44	02-04-06	16-04-06	3	-	-
22	44	02-04-06	16-04-06	4	-	-
22	44	02-04-06	16-04-06	5	-	-
22	44	02-04-06	16-04-06	6	-	-
22	44	02-04-06	16-04-06	7	-	-
22	44	02-04-06	16-04-06	8	-	-
22	44	02-04-06	16-04-06	9	-	-
22	44	02-04-06	16-04-06	10	-	-
22	44	02-04-06	16-04-06	11	-	-
22	44	02-04-06	16-04-06	12	-	-
22	44	02-04-06	16-04-06	13	-	-
22	44	02-04-06	16-04-06	14	-	-
22	44	02-04-06	16-04-06	15	-	-
23	45	02-04-06	16-04-06	1	-	-
23	45	02-04-06	16-04-06	2	-	-
23	45	02-04-06	16-04-06	3	-	-
23	45	02-04-06	16-04-06	4	-	-
23	45	02-04-06	16-04-06	5	1:37	Roe deer
23	45	02-04-06	16-04-06	6	-	-
23	45	02-04-06	16-04-06	7	-	-
23	45	02-04-06	16-04-06	8	-	-
23	45	02-04-06	16-04-06	9	-	-
23	45	02-04-06	16-04-06	10	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
23	45	02-04-06	16-04-06	11	-	-
23	45	02-04-06	16-04-06	12	4:54	Wild boar
23	45	02-04-06	16-04-06	13	13:06	Roe deer
23	45	02-04-06	16-04-06	14	-	-
23	45	02-04-06	16-04-06	15	-	-
23	45	02-04-06	16-04-06	15	5:19	Roe deer
23	46	02-04-06	16-04-06	1	15:55	Wild boar group
23	46	02-04-06	16-04-06	1	20:03	Wild boar
23	46	02-04-06	16-04-06	1	20:07	Wild boar group
23	46	02-04-06	16-04-06	2	2:52	Wild boar (F)
23	46	02-04-06	16-04-06	2	19:23	Wild boar
23	46	02-04-06	16-04-06	3	-	-
23	46	02-04-06	16-04-06	4	2:53	Wild boar (M)
23	46	02-04-06	16-04-06	4	20:44	Wild boar (M)
23	46	02-04-06	16-04-06	5	-	-
23	46	02-04-06	16-04-06	6	-	-
23	46	02-04-06	16-04-06	7	2:30	Wild boar group
23	46	02-04-06	16-04-06	8	2:03	Wild boar (M)
23	46	02-04-06	16-04-06	9	23:37	Wolf
23	46	02-04-06	16-04-06	10	20:37	Wild boar
23	46	02-04-06	16-04-06	11	5:58	Wild boar
23	46	02-04-06	16-04-06	12	6:01	Wild boar
23	46	02-04-06	16-04-06	13	8:00	Wild boar group
23	46	02-04-06	16-04-06	14	-	-
23	46	02-04-06	16-04-06	15	-	-
23	46	02-04-06	16-04-06	15	3:18	Wild boar (M)
24	47	02-04-06	16-04-06	1	20:16	Unknown
24	47	02-04-06	16-04-06	1	20:50	Wild boar
24	47	02-04-06	16-04-06	1	21:59	Wild boar
24	47	02-04-06	16-04-06	1	23:40	Wild boar (F)
24	47	02-04-06	16-04-06	2	6:04	Wild boar
24	47	02-04-06	16-04-06	2	19:50	Wild boar
24	47	02-04-06	16-04-06	3	-	-
24	47	02-04-06	16-04-06	4	21:18	Wild boar
24	47	02-04-06	16-04-06	5	0:58	Unknown
24	47	02-04-06	16-04-06	5	20:17	Wild boar
24	47	02-04-06	16-04-06	6	1:59	Wild boar
24	47	02-04-06	16-04-06	6	17:08	Unknown
24	47	02-04-06	16-04-06	7	2:48	Unknown
24	47	02-04-06	16-04-06	7	3:58	Wild boar (M)
24	47	02-04-06	16-04-06	7	8:09	Unknown
24	47	02-04-06	16-04-06	7	20:07	Unknown
24	47	02-04-06	16-04-06	8	2:30	Wild boar

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
24	47	02-04-06	16-04-06	9	-	-
24	47	02-04-06	16-04-06	10	-	-
24	47	02-04-06	16-04-06	11	0:30	Unknown
24	47	02-04-06	16-04-06	11	6:18	Unknown
24	47	02-04-06	16-04-06	11	17:20	Wildcat
24	47	02-04-06	16-04-06	12	5:12	Wild boar
24	47	02-04-06	16-04-06	12	22:02	Wild boar (M)
24	47	02-04-06	16-04-06	13	0:36	Wild boar
24	47	02-04-06	16-04-06	13	8:23	Unknown
24	47	02-04-06	16-04-06	13	23:12	Wolf
24	47	02-04-06	16-04-06	13	23:23	Wild boar (F)
24	47	02-04-06	16-04-06	14	-	-
24	47	02-04-06	16-04-06	15	21:35	Unknown
24	47	02-04-06	16-04-06	15	1:38	Wild boar (M)
24	47	02-04-06	16-04-06	15	23:35	Wild boar
24	47	02-04-06	16-04-06	15	1:31	Brown bear
24	47	02-04-06	16-04-06	15	8:00	Roe deer
24	47	02-04-06	16-04-06	12	11:35	Unknown
24	48	02-04-06	16-04-06	1	-	-
24	48	02-04-06	16-04-06	2	-	-
24	48	02-04-06	16-04-06	3	-	-
24	48	02-04-06	16-04-06	4	-	-
24	48	02-04-06	16-04-06	5	-	-
24	48	02-04-06	16-04-06	6	-	-
24	48	02-04-06	16-04-06	7	-	-
24	48	02-04-06	16-04-06	8	-	-
24	48	02-04-06	16-04-06	9	-	-
24	48	02-04-06	16-04-06	10	-	-
24	48	02-04-06	16-04-06	11	-	-
24	48	02-04-06	16-04-06	12	-	-
24	48	02-04-06	16-04-06	13	-	-
24	48	02-04-06	16-04-06	14	-	-
24	48	02-04-06	16-04-06	15	-	-
25	49	20-04-06	04-05-06	1	-	-
25	49	20-04-06	04-05-06	2	-	-
25	49	20-04-06	04-05-06	3	-	-
25	49	20-04-06	04-05-06	4	-	-
25	49	20-04-06	04-05-06	5	-	-
25	49	20-04-06	04-05-06	6	-	-
25	49	20-04-06	04-05-06	7	-	-
25	49	20-04-06	04-05-06	8	20:49	Wild boar (M)
25	49	20-04-06	04-05-06	9	-	-
25	49	20-04-06	04-05-06	10	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
25	49	20-04-06	04-05-06	11	-	-
25	49	20-04-06	04-05-06	12	-	-
25	49	20-04-06	04-05-06	13	-	-
25	49	20-04-06	04-05-06	14	-	-
25	49	20-04-06	04-05-06	15	-	-
25	50	20-04-06	04-05-06	1	15:30	Brown bear
25	50	20-04-06	04-05-06	2	-	-
25	50	20-04-06	04-05-06	3	-	-
25	50	20-04-06	04-05-06	4	-	-
25	50	20-04-06	04-05-06	5	-	-
25	50	20-04-06	04-05-06	6	-	-
25	50	20-04-06	04-05-06	7	-	-
25	50	20-04-06	04-05-06	8	-	-
25	50	20-04-06	04-05-06	9	6:15	Roe deer
25	50	20-04-06	04-05-06	9	21:10	Wild boar
25	50	20-04-06	04-05-06	10	-	-
25	50	20-04-06	04-05-06	11	-	-
25	50	20-04-06	04-05-06	12	-	-
25	50	20-04-06	04-05-06	13	-	-
25	50	20-04-06	04-05-06	14	-	-
25	50	20-04-06	04-05-06	15	-	-
26	51	20-04-06	04-05-06	1	-	-
26	51	20-04-06	04-05-06	2	-	-
26	51	20-04-06	04-05-06	3	-	-
26	51	20-04-06	04-05-06	4	-	-
26	51	20-04-06	04-05-06	5	-	-
26	51	20-04-06	04-05-06	6	-	-
26	51	20-04-06	04-05-06	7	-	-
26	51	20-04-06	04-05-06	8	-	-
26	51	20-04-06	04-05-06	9	-	-
26	51	20-04-06	04-05-06	10	-	-
26	51	20-04-06	04-05-06	11	19:07	Roe deer
26	51	20-04-06	04-05-06	12	-	-
26	51	20-04-06	04-05-06	13	-	-
26	51	20-04-06	04-05-06	14	-	-
26	51	20-04-06	04-05-06	15	-	-
26	52	20-04-06	04-05-06	1	-	-
26	52	20-04-06	04-05-06	2	-	-
26	52	20-04-06	04-05-06	3	-	-
26	52	20-04-06	04-05-06	4	-	-
26	52	20-04-06	04-05-06	5	-	-
26	52	20-04-06	04-05-06	6	-	-
26	52	20-04-06	04-05-06	7	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
26	52	20-04-06	04-05-06	8	-	-
26	52	20-04-06	04-05-06	9	21:05	Brown bear
26	52	20-04-06	04-05-06	10	-	-
26	52	20-04-06	04-05-06	11	-	-
26	52	20-04-06	04-05-06	12	-	-
26	52	20-04-06	04-05-06	13	-	-
26	52	20-04-06	04-05-06	14	-	-
26	52	20-04-06	04-05-06	15	-	-
27	53	20-04-06	04-05-06	1	-	-
27	53	20-04-06	04-05-06	2	-	-
27	53	20-04-06	04-05-06	3	-	-
27	53	20-04-06	04-05-06	4	-	-
27	53	20-04-06	04-05-06	5	-	-
27	53	20-04-06	04-05-06	6	-	-
27	53	20-04-06	04-05-06	7	-	-
27	53	20-04-06	04-05-06	8	1:44	Unknown
27	53	20-04-06	04-05-06	8	22:31	Brown bear
27	53	20-04-06	04-05-06	9	-	-
27	53	20-04-06	04-05-06	10	-	-
27	53	20-04-06	04-05-06	11	-	-
27	53	20-04-06	04-05-06	12	-	-
27	53	20-04-06	04-05-06	13	-	-
27	53	20-04-06	04-05-06	14	-	-
27	53	20-04-06	04-05-06	15	-	-
27	54	20-04-06	04-05-06	1	-	-
27	54	20-04-06	04-05-06	2	-	-
27	54	20-04-06	04-05-06	3	-	-
27	54	20-04-06	04-05-06	4	-	-
27	54	20-04-06	04-05-06	5	-	-
27	54	20-04-06	04-05-06	6	-	-
27	54	20-04-06	04-05-06	7	-	-
27	54	20-04-06	04-05-06	8	16:36	Unknown
27	54	20-04-06	04-05-06	9	-	-
27	54	20-04-06	04-05-06	10	-	-
27	54	20-04-06	04-05-06	11	-	-
27	54	20-04-06	04-05-06	12	-	-
27	54	20-04-06	04-05-06	13	-	-
27	54	20-04-06	04-05-06	14	-	-
27	54	20-04-06	04-05-06	15	-	-
28	55	20-04-06	04-05-06	1	-	-
28	55	20-04-06	04-05-06	2	-	-
28	55	20-04-06	04-05-06	3	-	-
28	55	20-04-06	04-05-06	4	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
28	55	20-04-06	04-05-06	5	23:47	Wild boar
28	55	20-04-06	04-05-06	6	-	-
28	55	20-04-06	04-05-06	7	-	-
28	55	20-04-06	04-05-06	8	-	-
28	55	20-04-06	04-05-06	9	-	-
28	55	20-04-06	04-05-06	10	-	-
28	55	20-04-06	04-05-06	11	-	-
28	55	20-04-06	04-05-06	12	-	-
28	55	20-04-06	04-05-06	13	-	-
28	55	20-04-06	04-05-06	14	-	-
28	55	20-04-06	04-05-06	15	-	-
28	56	20-04-06	04-05-06	1	-	-
28	56	20-04-06	04-05-06	2	-	-
28	56	20-04-06	04-05-06	3	-	-
28	56	20-04-06	04-05-06	4	-	-
28	56	20-04-06	04-05-06	5	21:31	Wild boar (M)
28	56	20-04-06	04-05-06	6	-	-
28	56	20-04-06	04-05-06	7	-	-
28	56	20-04-06	04-05-06	8	1:57	Wild boar
28	56	20-04-06	04-05-06	8	22:03	Brown bear
28	56	20-04-06	04-05-06	9	-	-
28	56	20-04-06	04-05-06	10	-	-
28	56	20-04-06	04-05-06	11	-	-
28	56	20-04-06	04-05-06	12	17:47	Roe deer
28	56	20-04-06	04-05-06	13	18:42	Wild boar (M)
28	56	20-04-06	04-05-06	14	-	-
28	56	20-04-06	04-05-06	15	-	-
29	57	21-04-06	05-05-06	1	-	-
29	57	21-04-06	05-05-06	2	-	-
29	57	21-04-06	05-05-06	3	-	-
29	57	21-04-06	05-05-06	4	-	-
29	57	21-04-06	05-05-06	5	-	-
29	57	21-04-06	05-05-06	6	-	-
29	57	21-04-06	05-05-06	7	-	-
29	57	21-04-06	05-05-06	8	-	-
29	57	21-04-06	05-05-06	9	10:04	Roe deer
29	57	21-04-06	05-05-06	10	22:59	Jackal
29	57	21-04-06	05-05-06	11	-	-
29	57	21-04-06	05-05-06	12	-	-
29	57	21-04-06	05-05-06	13	-	-
29	57	21-04-06	05-05-06	14	-	-
29	57	21-04-06	05-05-06	15	-	-
29	58	21-04-06	05-05-06	1	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
29	58	21-04-06	05-05-06	2	-	-
29	58	21-04-06	05-05-06	3	-	-
29	58	21-04-06	05-05-06	4	-	-
29	58	21-04-06	05-05-06	5	-	-
29	58	21-04-06	05-05-06	6	-	-
29	58	21-04-06	05-05-06	7	-	-
29	58	21-04-06	05-05-06	8	-	-
29	58	21-04-06	05-05-06	9	-	-
29	58	21-04-06	05-05-06	10	-	-
29	58	21-04-06	05-05-06	11	-	-
29	58	21-04-06	05-05-06	12	-	-
29	58	21-04-06	05-05-06	13	-	-
29	58	21-04-06	05-05-06	14	-	-
29	58	21-04-06	05-05-06	15	-	-
30	59	21-04-06	05-05-06	1	-	-
30	59	21-04-06	05-05-06	2	5:47	Red fox
30	59	21-04-06	05-05-06	3	-	-
30	59	21-04-06	05-05-06	4	-	-
30	59	21-04-06	05-05-06	5	-	-
30	59	21-04-06	05-05-06	6	-	-
30	59	21-04-06	05-05-06	7	21:10	Brown bear
30	59	21-04-06	05-05-06	8	-	-
30	59	21-04-06	05-05-06	9	-	-
30	59	21-04-06	05-05-06	10	-	-
30	59	21-04-06	05-05-06	11	-	-
30	59	21-04-06	05-05-06	12	-	-
30	59	21-04-06	05-05-06	13	21:29	Red fox
30	59	21-04-06	05-05-06	14	-	-
30	59	21-04-06	05-05-06	15	-	-
30	60	21-04-06	05-05-06	1	-	-
30	60	21-04-06	05-05-06	2	20:47	Red fox
30	60	21-04-06	05-05-06	3	-	-
30	60	21-04-06	05-05-06	4	-	-
30	60	21-04-06	05-05-06	5	-	-
30	60	21-04-06	05-05-06	6	21:47	Wolf
30	60	21-04-06	05-05-06	6	21:50	Wolf
30	60	21-04-06	05-05-06	7	21:15	Brown bear
30	60	21-04-06	05-05-06	8	-	-
30	60	21-04-06	05-05-06	9	14:11	Red fox
30	60	21-04-06	05-05-06	9	23:13	Red fox
30	60	21-04-06	05-05-06	10	20:40	Unknown
30	60	21-04-06	05-05-06	11	22:54	Red fox
30	60	21-04-06	05-05-06	12	23:47	Red fox

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
30	60	21-04-06	05-05-06	13	-	-
30	60	21-04-06	05-05-06	14	23:59	Red fox
30	60	21-04-06	05-05-06	15	-	-
31	61	21-04-06	05-05-06	1	11:59	Unknown
31	61	21-04-06	05-05-06	2	7:30	Red fox
31	61	21-04-06	05-05-06	3	-	-
31	61	21-04-06	05-05-06	4	-	-
31	61	21-04-06	05-05-06	5	-	-
31	61	21-04-06	05-05-06	6	7:52	Red fox
31	61	21-04-06	05-05-06	6	23:42	Wild boar
31	61	21-04-06	05-05-06	7	-	-
31	61	21-04-06	05-05-06	8	2:23	Wild boar (F)
31	61	21-04-06	05-05-06	8	2:25	Wild boar
31	61	21-04-06	05-05-06	9	-	-
31	61	21-04-06	05-05-06	10	-	-
31	61	21-04-06	05-05-06	11	14:53	Wild boar group
31	61	21-04-06	05-05-06	12	10:50	Wild boar
31	61	21-04-06	05-05-06	13	7:30	Wild boar
31	61	21-04-06	05-05-06	14	-	-
31	61	21-04-06	05-05-06	15	-	-
31	62	21-04-06	05-05-06	1	-	-
31	62	21-04-06	05-05-06	2	0:15	Unknown
31	62	21-04-06	05-05-06	3	-	-
31	62	21-04-06	05-05-06	4	-	-
31	62	21-04-06	05-05-06	5	-	-
31	62	21-04-06	05-05-06	6	-	-
31	62	21-04-06	05-05-06	7	-	-
31	62	21-04-06	05-05-06	8	2:24	Unknown
31	62	21-04-06	05-05-06	8	20:39	Wild boar group
31	62	21-04-06	05-05-06	9	13:28	Unknown
31	62	21-04-06	05-05-06	9	19:37	Wild boar
31	62	21-04-06	05-05-06	10	2:02	Wild boar
31	62	21-04-06	05-05-06	10	21:08	Red fox
31	62	21-04-06	05-05-06	11	14:51	Wild boar
31	62	21-04-06	05-05-06	11	20:04	Unknown
31	62	21-04-06	05-05-06	12	7:48	Wild boar
31	62	21-04-06	05-05-06	13	2:04	Unknown
31	62	21-04-06	05-05-06	13	5:47	Unknown
31	62	21-04-06	05-05-06	14	0:07	Unknown
31	62	21-04-06	05-05-06	15	5:48	Unknown
32	63	21-04-06	05-05-06	1	-	-
32	63	21-04-06	05-05-06	2	-	-
32	63	21-04-06	05-05-06	3	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
32	63	21-04-06	05-05-06	4	-	-
32	63	21-04-06	05-05-06	5	6:36	Wild boar
32	63	21-04-06	05-05-06	6	19:15	Wild boar
32	63	21-04-06	05-05-06	7	-	-
32	63	21-04-06	05-05-06	8	-	-
32	63	21-04-06	05-05-06	9	19:55	Wild boar
32	63	21-04-06	05-05-06	10	-	-
32	63	21-04-06	05-05-06	11	7:04	Roe deer
32	63	21-04-06	05-05-06	11	20:31	Roe deer
32	63	21-04-06	05-05-06	12	0:12	Roe deer
32	63	21-04-06	05-05-06	13	5:57	Roe deer
32	63	21-04-06	05-05-06	14	-	-
32	63	21-04-06	05-05-06	15	-	-
32	64	21-04-06	05-05-06	1	-	-
32	64	21-04-06	05-05-06	2	-	-
32	64	21-04-06	05-05-06	3	-	-
32	64	21-04-06	05-05-06	4	-	-
32	64	21-04-06	05-05-06	5	-	-
32	64	21-04-06	05-05-06	6	-	-
32	64	21-04-06	05-05-06	7	-	-
32	64	21-04-06	05-05-06	8	-	-
32	64	21-04-06	05-05-06	9	-	-
32	64	21-04-06	05-05-06	10	-	-
32	64	21-04-06	05-05-06	11	-	-
32	64	21-04-06	05-05-06	12	-	-
32	64	21-04-06	05-05-06	13	-	-
32	64	21-04-06	05-05-06	14	-	-
32	64	21-04-06	05-05-06	15	-	-
33	65	07-05-06	21-05-06	1	-	-
33	65	07-05-06	21-05-06	2	6:06	Roe deer
33	65	07-05-06	21-05-06	3	20:09	Brown bear
33	65	07-05-06	21-05-06	4	-	-
33	65	07-05-06	21-05-06	5	-	-
33	65	07-05-06	21-05-06	6	-	-
33	65	07-05-06	21-05-06	7	-	-
33	65	07-05-06	21-05-06	8	-	-
33	65	07-05-06	21-05-06	9	-	-
33	65	07-05-06	21-05-06	10	-	-
33	65	07-05-06	21-05-06	11	19:45	Wild boar (M)
33	65	07-05-06	21-05-06	12	-	-
33	65	07-05-06	21-05-06	13	-	-
33	65	07-05-06	21-05-06	14	-	-
33	65	07-05-06	21-05-06	15	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
33	66	07-05-06	21-05-06	1	-	-
33	66	07-05-06	21-05-06	2	-	-
33	66	07-05-06	21-05-06	3	-	-
33	66	07-05-06	21-05-06	4	-	-
33	66	07-05-06	21-05-06	5	8:55	Wild boar
33	66	07-05-06	21-05-06	6	-	-
33	66	07-05-06	21-05-06	7	-	-
33	66	07-05-06	21-05-06	8	-	-
33	66	07-05-06	21-05-06	9	-	-
33	66	07-05-06	21-05-06	10	-	-
33	66	07-05-06	21-05-06	11	-	-
33	66	07-05-06	21-05-06	12	-	-
33	66	07-05-06	21-05-06	13	-	-
33	66	07-05-06	21-05-06	14	-	-
33	66	07-05-06	21-05-06	15	-	-
34	67	07-05-06	21-05-06	1	-	-
34	67	07-05-06	21-05-06	2	2:56	Red fox
34	67	07-05-06	21-05-06	3	-	-
34	67	07-05-06	21-05-06	4	-	-
34	67	07-05-06	21-05-06	5	-	-
34	67	07-05-06	21-05-06	6	-	-
34	67	07-05-06	21-05-06	7	-	-
34	67	07-05-06	21-05-06	8	-	-
34	67	07-05-06	21-05-06	9	-	-
34	67	07-05-06	21-05-06	10	-	-
34	67	07-05-06	21-05-06	11	-	-
34	67	07-05-06	21-05-06	12	-	-
34	67	07-05-06	21-05-06	13	-	-
34	67	07-05-06	21-05-06	14	-	-
34	67	07-05-06	21-05-06	15	-	-
34	68	07-05-06	21-05-06	1	-	-
34	68	07-05-06	21-05-06	2	-	-
34	68	07-05-06	21-05-06	3	-	-
34	68	07-05-06	21-05-06	4	-	-
34	68	07-05-06	21-05-06	5	-	-
34	68	07-05-06	21-05-06	6	-	-
34	68	07-05-06	21-05-06	7	-	-
34	68	07-05-06	21-05-06	8	-	-
34	68	07-05-06	21-05-06	9	-	-
34	68	07-05-06	21-05-06	10	-	-
34	68	07-05-06	21-05-06	11	-	-
34	68	07-05-06	21-05-06	12	-	-
34	68	07-05-06	21-05-06	13	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
34	68	07-05-06	21-05-06	14	-	-
34	68	07-05-06	21-05-06	15	-	-
35	69	07-05-06	21-05-06	1	-	-
35	69	07-05-06	21-05-06	2	23:05	Roe deer
35	69	07-05-06	21-05-06	3	8:40	Roe deer group
35	69	07-05-06	21-05-06	4	-	-
35	69	07-05-06	21-05-06	5	3:41	Roe deer
35	69	07-05-06	21-05-06	6	-	-
35	69	07-05-06	21-05-06	7	-	-
35	69	07-05-06	21-05-06	8	-	-
35	69	07-05-06	21-05-06	9	-	-
35	69	07-05-06	21-05-06	10	-	-
35	69	07-05-06	21-05-06	11	-	-
35	69	07-05-06	21-05-06	12	-	-
35	69	07-05-06	21-05-06	13	2:34	Roe deer
35	69	07-05-06	21-05-06	14	19:57	Wild boar
35	69	07-05-06	21-05-06	15	-	-
35	70	07-05-06	21-05-06	1	-	-
35	70	07-05-06	21-05-06	2	-	-
35	70	07-05-06	21-05-06	3	-	-
35	70	07-05-06	21-05-06	4	23:55	Wolf
35	70	07-05-06	21-05-06	5	-	-
35	70	07-05-06	21-05-06	6	-	-
35	70	07-05-06	21-05-06	7	-	-
35	70	07-05-06	21-05-06	8	-	-
35	70	07-05-06	21-05-06	9	-	-
35	70	07-05-06	21-05-06	10	-	-
35	70	07-05-06	21-05-06	11	-	-
35	70	07-05-06	21-05-06	12	-	-
35	70	07-05-06	21-05-06	13	-	-
35	70	07-05-06	21-05-06	14	23:39	Brown bear
35	70	07-05-06	21-05-06	15	-	-
36	71	07-05-06	21-05-06	1	-	-
36	71	07-05-06	21-05-06	2	-	-
36	71	07-05-06	21-05-06	3	-	-
36	71	07-05-06	21-05-06	4	-	-
36	71	07-05-06	21-05-06	5	-	-
36	71	07-05-06	21-05-06	6	-	-
36	71	07-05-06	21-05-06	7	-	-
36	71	07-05-06	21-05-06	8	-	-
36	71	07-05-06	21-05-06	9	-	-
36	71	07-05-06	21-05-06	10	-	-
36	71	07-05-06	21-05-06	11	10:13	Wolf

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
36	71	07-05-06	21-05-06	11	22:15	Roe deer
36	71	07-05-06	21-05-06	12	20:39	Wild boar
36	71	07-05-06	21-05-06	13	-	-
36	71	07-05-06	21-05-06	14	14:25	Roe deer
36	71	07-05-06	21-05-06	15	-	-
36	72	07-05-06	21-05-06	1	-	-
36	72	07-05-06	21-05-06	2	-	-
36	72	07-05-06	21-05-06	3	-	-
36	72	07-05-06	21-05-06	4	-	-
36	72	07-05-06	21-05-06	5	-	-
36	72	07-05-06	21-05-06	6	-	-
36	72	07-05-06	21-05-06	7	-	-
36	72	07-05-06	21-05-06	8	-	-
36	72	07-05-06	21-05-06	9	-	-
36	72	07-05-06	21-05-06	10	-	-
36	72	07-05-06	21-05-06	11	-	-
36	72	07-05-06	21-05-06	12	-	-
36	72	07-05-06	21-05-06	13	-	-
36	72	07-05-06	21-05-06	14	-	-
36	72	07-05-06	21-05-06	15	-	-
37	73	07-05-06	21-05-06	1	-	-
37	73	07-05-06	21-05-06	2	-	-
37	73	07-05-06	21-05-06	3	-	-
37	73	07-05-06	21-05-06	4	-	-
37	73	07-05-06	21-05-06	5	-	-
37	73	07-05-06	21-05-06	6	-	-
37	73	07-05-06	21-05-06	7	-	-
37	73	07-05-06	21-05-06	8	-	-
37	73	07-05-06	21-05-06	9	-	-
37	73	07-05-06	21-05-06	10	-	-
37	73	07-05-06	21-05-06	11	-	-
37	73	07-05-06	21-05-06	12	-	-
37	73	07-05-06	21-05-06	13	-	-
37	73	07-05-06	21-05-06	14	-	-
37	73	07-05-06	21-05-06	15	-	-
37	74	07-05-06	21-05-06	1	-	-
37	74	07-05-06	21-05-06	2	16:13	Roe deer
37	74	07-05-06	21-05-06	2	20:47	Wild boar (M)
37	74	07-05-06	21-05-06	3	-	-
37	74	07-05-06	21-05-06	4	21:48	Wild boar
37	74	07-05-06	21-05-06	5	9:15	Wild boar
37	74	07-05-06	21-05-06	5	16:37	Roe deer
37	74	07-05-06	21-05-06	5	18:49	Roe deer

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
37	74	07-05-06	21-05-06	6	5:44	Unknown
37	74	07-05-06	21-05-06	7	20:34	Unknown
37	74	07-05-06	21-05-06	8	-	-
37	74	07-05-06	21-05-06	9	-	-
37	74	07-05-06	21-05-06	10	21:29	Red fox
37	74	07-05-06	21-05-06	11	-	-
37	74	07-05-06	21-05-06	12	6:14	Roe deer
37	74	07-05-06	21-05-06	13	-	-
37	74	07-05-06	21-05-06	14	-	-
37	74	07-05-06	21-05-06	15	-	-
38	75	07-05-06	21-05-06	1	-	-
38	75	07-05-06	21-05-06	2	-	-
38	75	07-05-06	21-05-06	3	-	-
38	75	07-05-06	21-05-06	4	-	-
38	75	07-05-06	21-05-06	5	-	-
38	75	07-05-06	21-05-06	6	-	-
38	75	07-05-06	21-05-06	7	-	-
38	75	07-05-06	21-05-06	8	-	-
38	75	07-05-06	21-05-06	9	-	-
38	75	07-05-06	21-05-06	10	-	-
38	75	07-05-06	21-05-06	11	-	-
38	75	07-05-06	21-05-06	12	-	-
38	75	07-05-06	21-05-06	13	-	-
38	75	07-05-06	21-05-06	14	-	-
38	75	07-05-06	21-05-06	15	-	-
38	76	07-05-06	21-05-06	1	-	-
38	76	07-05-06	21-05-06	2	21:36	Wild boar
38	76	07-05-06	21-05-06	3	-	-
38	76	07-05-06	21-05-06	4	-	-
38	76	07-05-06	21-05-06	5	-	-
38	76	07-05-06	21-05-06	6	-	-
38	76	07-05-06	21-05-06	7	13:49	Unknown
38	76	07-05-06	21-05-06	7	18:59	Wolf
38	76	07-05-06	21-05-06	8	-	-
38	76	07-05-06	21-05-06	9	-	-
38	76	07-05-06	21-05-06	10	-	-
38	76	07-05-06	21-05-06	11	-	-
38	76	07-05-06	21-05-06	12	-	-
38	76	07-05-06	21-05-06	13	6:15	Brown bear
38	76	07-05-06	21-05-06	14	-	-
38	76	07-05-06	21-05-06	15	-	-
39	77	07-05-06	21-05-06	1	-	-
39	77	07-05-06	21-05-06	2	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
39	77	07-05-06	21-05-06	3	-	-
39	77	07-05-06	21-05-06	4	4:09	Unknown
39	77	07-05-06	21-05-06	5	-	-
39	77	07-05-06	21-05-06	6	-	-
39	77	07-05-06	21-05-06	7	-	-
39	77	07-05-06	21-05-06	8	-	-
39	77	07-05-06	21-05-06	9	-	-
39	77	07-05-06	21-05-06	10	22:16	Brown bear
39	77	07-05-06	21-05-06	11	-	-
39	77	07-05-06	21-05-06	12	1:46	Wildcat
39	77	07-05-06	21-05-06	13	-	-
39	77	07-05-06	21-05-06	14	21:35	Unknown
39	77	07-05-06	21-05-06	15	3:20	Unknown
39	78	07-05-06	21-05-06	1	-	-
39	78	07-05-06	21-05-06	2	-	-
39	78	07-05-06	21-05-06	3	-	-
39	78	07-05-06	21-05-06	4	-	-
39	78	07-05-06	21-05-06	5	-	-
39	78	07-05-06	21-05-06	6	-	-
39	78	07-05-06	21-05-06	7	-	-
39	78	07-05-06	21-05-06	8	9:17	Unknown
39	78	07-05-06	21-05-06	9	-	-
39	78	07-05-06	21-05-06	10	22:13	Brown bear
39	78	07-05-06	21-05-06	11	3:25	Unknown
39	78	07-05-06	21-05-06	11	8:43	Unknown
39	78	07-05-06	21-05-06	12	23:19	Unknown
39	78	07-05-06	21-05-06	13	-	-
39	78	07-05-06	21-05-06	14	-	-
39	78	07-05-06	21-05-06	15	-	-
40	79	07-05-06	21-05-06	1	-	-
40	79	07-05-06	21-05-06	2	-	-
40	79	07-05-06	21-05-06	3	-	-
40	79	07-05-06	21-05-06	4	1:40	Wildcat
40	79	07-05-06	21-05-06	5	-	-
40	79	07-05-06	21-05-06	6	-	-
40	79	07-05-06	21-05-06	7	-	-
40	79	07-05-06	21-05-06	8	-	-
40	79	07-05-06	21-05-06	9	18:45	Wild boar
40	79	07-05-06	21-05-06	9	18:42	Wild boar group
40	79	07-05-06	21-05-06	10	-	-
40	79	07-05-06	21-05-06	11	-	-
40	79	07-05-06	21-05-06	12	-	-
40	79	07-05-06	21-05-06	13	-	-

Table C cont'd.

Cell Code	Station Code	First Survey Day	Last Survey Day	Day No.	Time	Species
40	79	07-05-06	21-05-06	14	-	-
40	79	07-05-06	21-05-06	15	-	-
40	80	07-05-06	21-05-06	1	-	-
40	80	07-05-06	21-05-06	2	5:14	Wild boar
40	80	07-05-06	21-05-06	3	-	-
40	80	07-05-06	21-05-06	4	-	-
40	80	07-05-06	21-05-06	5	5:35	Wild boar
40	80	07-05-06	21-05-06	6	-	-
40	80	07-05-06	21-05-06	7	-	-
40	80	07-05-06	21-05-06	8	-	-
40	80	07-05-06	21-05-06	9	-	-
40	80	07-05-06	21-05-06	10	-	-
40	80	07-05-06	21-05-06	11	-	-
40	80	07-05-06	21-05-06	12	-	-
40	80	07-05-06	21-05-06	13	-	-
40	80	07-05-06	21-05-06	14	-	-
40	80	07-05-06	21-05-06	15	21:03	Roe deer

CURRICULUM VITAE

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EDUCATION

Degree	Institution	Year of Graduation
MS	METU, Biology	2001
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BS	METU, Biology	1997
High School	Ankara Atatürk Anadolu High School (AAAL)	1991

WORK EXPERIENCE

Year	Place	Enrollment
2006-present	Nature Society	Mammal Research Coordinator
2000-2005	Turkish Society for the Conservation of Nature - DHKD/World Wide Fund for Nature (WWF) Turkey	Wildlife Biologist

FOREIGN LANGUAGES

Advanced English.

PEER REVIEWED ARTICLES

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2007. A Review of approaches to resolve agricultural conflicts. 18th International Conference on Bear Research and Management. 4-11 November, Monterrey, Mexico.

2006. Implementing bear education and damage prevention programs in rural Turkey: Bearmobile experience. 17th International Conference on Bear Research and Management. October 2nd-6th, Karuizawa Town, Japan.

2006. Community-based programs for preventing human-bear conflicts. 17th International Conference on Bear Research and Management. October 2nd-6th, Karuizawa Town, Japan.

2005. Brown bear – human conflict in Turkey. 16th IBA Conference, September 27th – October 1st 2005. Riva del Garda, Trentino, Italy.

2005. What do we really know about canid predation in marine turtle nesting sites in Turkey? 2nd Mediterranean Conference on Marine Turtles. Turkey.

2004. Biodiversity in Turkey. 23rd. Annual Conference on U.S.-Turkish Relations, 4-7 April 2004, Washington, DC.USA.

2004. Is Caspian Tiger Extinct in Turkey? 23rd. Annual Conference on U.S.-Turkish Relations, 4-7 April 2004, Washington, DC. USA.

2004. Current Status of the gray wolf, its prey and human-wolf interaction in Turkey. World Wolf Congress. 25-28 September 2004. Banff, Alberta, Canada.

2003. Large Carnivores of Turkey: Current status of wolf, brown bear, striped hyaena and Anatolian leopard and their conservation priorities. 4th European Congress of Mammalogy, 27 July -1 August 2003, Brno, Czech Republic.

2002. The status of brown bear in Turkey and priorities for their research and conservation. International Association for Bear Research and Management, 14th International Conference on Bear Research and Management, 28 July-2 August 2002, Steinkjer, Norway.

2001. The Wolf in Turkey: Its Status and the Conservation Challenges. Canid Biology and Conservation Conference, 17-21 September 2001, Oxford University, UK.

PRESENTATIONS AT NATIONAL CONGRESS

2004. Distribution of gray wolves, their prey species, human-wolf interaction in Bolu: National priorities and recommendations for wolf conservation and management in Turkey. V. National Ecology and Environment Congress, 5-8 October 2004, Bolu, Turkey.

2004. The striped hyaena and other large mammals of Southeastern Turkey and recommendations for their conservation. V. National Ecology and Environment Congress, 5-8 October 2004, Bolu, Turkey.

2004. Status of brown bears in Turkey and priorities for their conservation and management. V. National Ecology and Environment Congress, 5-8 October 2004, Bolu, Turkey.

APPOINTED PROFESSIONAL MEMBERSHIPS

Board Member/Society for Conservation Biology European Section.
Co-Chair/World Conservation Union (IUCN) South Asian Brown Bear Expert Team.
Member/IUCN Wolf Specialist Group.
Member/IUCN Hyaena Specialist Group.
Member/IUCN Cat Specialist Group.
Member/IUCN Canid Specialist Group.

SCHOLARSHIPS, FELLOWSHIPS AND AWARDS

2002. Second best oral presentation award. 14th International Conference on Bear Research and Management, 28 July-2 August 2002, Steinkjer, Norway.

2001. German Academic Exchange Service (DAAD) Scholarship for Ph.D. in Technical University of Munich, Munich, Germany.

1999. Research Fellow. Mediterranean Agronomic Institute of Chania (MAICh), Crete, Greece.