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Camera trapping of medium and large-sized mammals in western Black Sea deciduous forests in Turkey

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Abstract: Camera trapping is one of the most effective methods for mammal inventories in most habitats and conditions. This study is based on the mammal records of a camera trap study in Northwest Anatolia. The study area was about 3500 km^2, and the study was carried out between May 2014 and May 2015. A total of 62 sites were surveyed, resulting in 3653 records of 16 mammal species (*Sciurus anomalus*, *Erinaceus concolor*, *Felis silvestris*, *Canis lupus*, *Canis aureus*, *Vulpes vulpes*, *Ursus arctos*, *Meles meles*, *Martes foina*, *Martes martes*, *Mustela nivalis*, *Lutra lutra*, *Sus scrofa*, *Capreolus capreolus*, *Lepus europaeus*, *Cervus elaphus*) in 11,868 camera trapping days. The highest detection rate among the species was that of *Sus scrofa* (36.57%), followed by *Martes* spp. (20.35%) and *Canis aureus* (19.44%). Overall trap success for all species detected was 30.78% (recorded number/100 camera trapping days). It was detected that mammal species diversity was higher in natural forested lands than in human-affected areas. Species diversity in the study area was recorded to be significantly higher than the results of other studies from different parts of Turkey. We present here a detailed inventory, distribution data, and contemporary diversity data for the study area, and comparative data for further studies.

Key words: Detection rate, trapping success, conservation, carnivores, ungulates

1. Introduction

The Mediterranean region hosts 321 mammal species (Temple and Cuttelod, 2009), 154 of which are found in Turkey, including about 20 large and medium-sized mammals (Kumerloeve, 1975; Doğramacı, 1989; Kurtonur et al., 1996; Kryštufek and Vohralík, 2001, 2005, 2009; Yiğit et al., 2006, 2016). One in 6 (16.5%) Mediterranean mammals are threatened with extinction on a regional scale, with a further 8% assessed as near threatened (Temple and Cuttelod, 2009). Additionally, about 27% of Mediterranean mammals have declining populations and 31% are stable, while for 40% the population trend is unknown; only 3% of mammal species populations are increasing (Temple and Cuttelod, 2009). Habitat destruction and degradation is the greatest threat to Mediterranean mammals, caused by a variety of factors including agricultural intensification, urbanization, pollution, and climate change. The other major threats are human disturbance, overexploitation, and invasive species (Temple and Cuttelod, 2009).

Camera trapping has developed as the most effective method for mammal inventories in most habitats and conditions (Cutler and Swann, 1999; Silveria et al., 2003; Sanderson, 2004; Tobler et al., 2008). Camera traps allow scientists to monitor and detect wild species that are hard to monitor without catching or physically handling them (Kelly and Holub, 2008).

Despite there being many studies on Turkish mammals, information on the ecology and distribution of many of the mammal species is quite inadequate (Can and Togan, 2004; Can, 2008; İlemin, 2009; İlemin and Gürkan, 2010; Soyumert, 2010; Soyumert et al., 2010; Akbaba and Ayaş, 2012; Albayrak et al., 2012; İlemin, 2014; Çoğal and Sözen, 2017). Though some records for large and medium-sized mammal species for Zonguldak Province have been provided by some researchers (Kumerloeve, 1967; Kryštufek and Vohralík, 2009), no detailed studies have occurred and most of the distribution maps were estimated without any definite records. That is why updated data collection of mammal species' occurrence are necessary for the region for further studies with protection, management, and ecological purposes.

The aim of this study was to record medium-sized and large mammal species distribution in Zonguldak Province using camera traps. We also aimed to determine the detection rates and diversity of the species in order to create their distribution maps, to compare diversity of species of the study area with other parts of Turkey, and, finally, to provide an inventory list for further studies.

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2. Materials and methods

2.1. Study area

The study was conducted in an area of approximately 3500 km^2 covering Zonguldak Province and close surroundings in the western Black Sea region in the Anatolian part of Turkey. According to the ecological regions defined by Olson and Dinerstein (2002), the area covering Zonguldak, coded PA0422, is defined as Euxine–Colchic deciduous forests. This region is dominated by *Fagus orientalis* and *Pinus nigra* forests. Forests of oak species and bushes also cover a significant part of the region. The study area was ecologically divided into two regions: Region A is a human populated area of villages and agricultural fields. Forest has mostly been destroyed in this area, and open areas such as agricultural fields are dominant. Land use changes have significantly affected this region. The elevation in this area ranges from 0 to 650 m a.s.l. This area extends along the coastal zone of study area (Figure). The stations Tepeören, Ilıksu, Dağlıca1, Dağlıca2, Dağlıca3, Dağlıca4, Kurtköy1, Kurtköy2, Kurtköy3, and Kurtköy4 are located in Region A. Region B is located behind the coastal zone. The area is mostly natural and covered mostly by old deciduous forest, and is generally higher than Region A, with elevations from 250 to 1420 m a.s.l. (Figure) The stations Belen1, Belen2, Belen3, Belen4, Gümeli1, Gümeli2, Gümeli3, Gümeli4, Sütlüce1, Sütlüce2, Sütlüce3, Sütlüce4, Beldibi1, Beldibi2, Beldibi3, and Beldibi4 are located in Region B.

2.2. Camera trap study

The camera trap study was conducted between May 2014 and May 2015, for a trapping period of 1 year, using a total of 62 camera traps (29 Bushnell NatureView Cam, and 33 Bushnell Trophy Cam; Bushnell, Overland Park, MO, USA) (Figure; Appendix 1). In total, 26 camera traps were each left at the same station for a year during the study. Opportunistic camera trap sampling was also carried out to check the accuracy of records taken from prior surveys conducted in the region: 36 camera traps were placed in diverse stations for different time periods (26 camera traps were set for at least 2–5 months for medium-sized and large mammals, and 10 camera traps were set for at least 20 days to 2 months at different river edges for the Eurasian otter). Since habitats across Zonguldak are mostly similar, areas selected from different regions were divided into grid cells of 4 km^2 and 1 camera trap was placed in the middle of each cell (Sanderson, 2004). At the beginning of the study, we attempted to reach the center point of each cell, and then the most appropriate point was determined based on wildlife paths, traces (footprints), and signs (feces, hair, food remains, etc.) within a 200-m diameter of the center point. The camera trap was set here. Based on this point, the distance between 2 camera traps was aimed to be 2 km, and the distance between 2 camera traps was rendered to have a smaller coverage than the home range of the species (O'Brien, 2011). Camera traps were set 30–50 cm higher than ground level. The elevation of the stations ranged between 15 m and 1416 m a.s.l. All camera trap settings were adjusted to remain at maximum sensitivity, which was a trigger interval set for 1 s and 2 pictures taken each trigger, to detect all species, even small species such as squirrels (Silver et al., 2004; Sanderson, 2004).

2.3. Data analysis

We summarized the total number of photographs taken, identifiable animals in photographs (events), and trap-

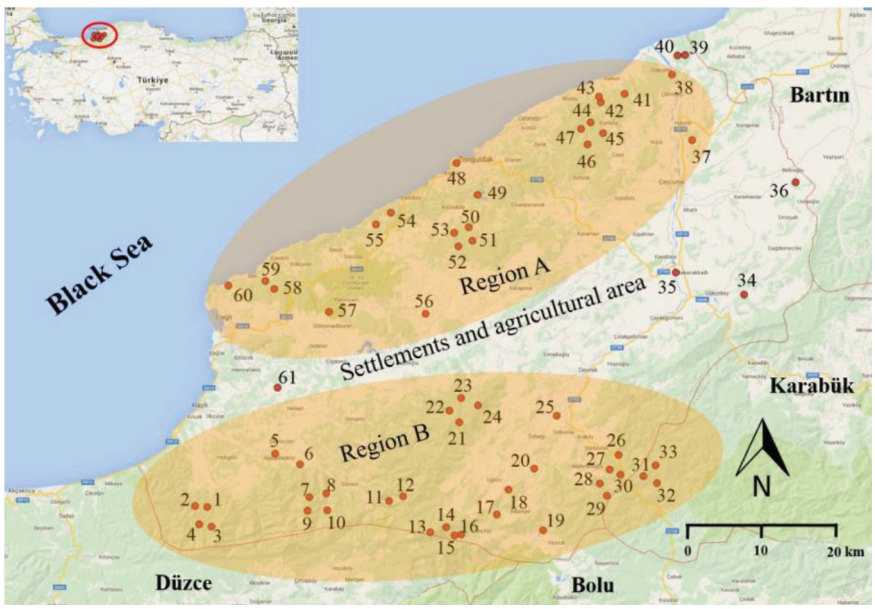

Figure. Camera traps points (l) in study area.

nights of effort after subtracting days where cameras malfunctioned or ran out of SD (secure digital) cards or batteries. Individual events for each species were separated by a minimum of 30 min (Silver et al., 2004; Kelly, 2008). The Shannon–Weiner (H) index was used to determine species diversity (the proportion of species relative to the total number of species [pi] is calculated, and then multiplied by the natural logarithm of this proportion [lnpi], and the resulting product is summed across species and multiplied by –1). Detection rate (total number of records/total number of camera trapping days × 100) of the species was calculated as given by Kays et al. (2009). Calculations of diversity for the species were made for 6 regions that represent Zonguldak Province. There were 4 camera trapping stations in each region, and these camera traps were left in place and functioning for the entire period of May–December 2014. The most suitable records, which were those taken from the traps that worked simultaneously and seamlessly, taken during the initial 8-month period, were included in the calculations in order to avoid any possible flaws. Species diversity analyses were also made for both regions (regions A and B). The analyses of diversity of species were made based on the records taken from camera traps that operated simultaneously between May and December 2014 in Regions A and B.

3. Results

3.1. Species distribution

A total of 16 mammal species were detected (Table 1). During the study, 3653 photos of large and medium-sized mammals were recorded as a result of 11,868 camera trapping days (Appendix 2). To distinguish *M. foina* and *M. martes* from photos was impossible in most cases. In such cases, the records were marked as *Martes* spp. In the more distinct photos, the exact species were indicated as *M. foina* or *M. martes*.

Cervus elaphus and *L. europaeus* records were taken only from Region B. *Capreolus capreolus*, *U. arctos*, and *C. lupus* records were taken mostly from Region B, and only once from region A (localities 52–53).

Table 1. Detected species, number of camera traps where species were detected, number of records, camera trapping days of stations, detection rates (total number of records/total number of camera trapping days × 100), and camera trapping days until the first detection of the species.

Species (common name)	Number of camera traps that captured the species	Number of records	CTDs of stations where the species was detected	Detection rate	CTDs until the first detection of the species
Sus scrofa (wild boar)	47	1064	11,268	8.97	1
Martes spp. (martens)	41	744	10,813	6.27	1
Canis aureus (golden jackal)	43	565	9949	4.76	2
Erinaceus concolor (hedgehog)	26	261	7371	2.20	1
Capreolus capreolus (European roe deer)	23	235	6203	1.98	2
Felis silvestris (wildcat)	32	221	9319	1.86	1
Meles meles (Eurasian badger)	22	218	6862	1.84	1
Vulpes vulpes (red fox)	30	129	7810	1.09	11
Sciurus anomalus (Caucasian squirrel)	13	127	3584	1.07	2
Ursus arctos (brown bear)	16	39	4911	0.33	25
Lepus europaeus (brown hare)	4	14	521	0.12	-
Lutra lutra (Eurasian otter)	4	10	105	0.08	-
Martes martes (pine marten)	5	7	1633	0.06	26
Canis lupus (gray wolf)	5	6	1482	0.05	-
Cervus elaphus (red deer)	4	6	881	0.05	-
Martes foina (beech marten)	3	4	558	0.03	3
Mustela nivalis (weasel)	2	3	394	0.03	-
Total no. of camera trapping days	11,868				
Total no. of records	3653				
Total detection rate (NR/total number of camera trapping days × 100)				30.78	

All other species were common and recorded from most parts of the study area; however, *S. scrofa* (52.72%), *C. aureus* (26.79%), *E. concolor* (7.15%), and *M. meles* (3.91%) were more common in Region A (n = 1049).

3.2. Detection rates of species

The detection rate, determined from the number of records (filtered data) over the total camera trapping days (sum of the days they operated flawlessly), is 30.78 for each 100 camera trapping days (CTDs). Among the 3653 records, the highest detection rates belong to *Sus scrofa* (29.14%), *Martes* spp. (20.35%), and *Canis aureus* (15.35%), and the detection rates of all other species constitute only 10.79% of the total detection rate (Table 1).

3.3. Species diversity in the study area

The Shannon_H index for the whole study area is 2.04. The Shannon_H index was determined for the 6 regions that represent Zonguldak Province in terms of calculations of species diversity: Beldibi (H = 2), Belen (H = 1.9), Sütlüce (H = 1.7), Gümeli (H = 1.7), Kurtköy (H = 1.6), and Dağlıca (H = 1.3).

According to the Shannon_H analysis, outcomes of species diversity in Region B (H = 2) are higher than in Region A (H = 1.49).

4. Discussion

This camera trapping survey revealed the presence of carnivores, herbivores, and insectivores in Zonguldak in the northwestern Black Sea region. Possible records of jungle cat, fallow deer, wild goat, and marbled polecat had been suggested in the area (Kumerloeve, 1967; Kryštufek and Vohralík, 2009); however, despite many camera trapping efforts and an extended survey period, no signs of these species were detected in this study. Soyumert (2010) did not record these species in her study area in Bartın, which borders Zonguldak. A number of researchers have stated that the lynx shows a probable distribution in this region (Kumerloeve, 1967; Turan, 1984; Kryštufek and Vohralík, 2009). Lynx were recorded from west of Ankara as the closest locality to Zonguldak (Ambarlı et al., 2010; Mengüllüoğlu, 2010; Akbaba and Ayaş, 2012). Can (2008) did not detect this species in a photo trap study performed in Yenice Forest close to Zonguldak Province.

Wild boar was the most frequently detected species, with 29.15% of the approximate detection rates of the species detected in Zonguldak. Similarly, this species has also been recorded from some other parts of Turkey as the most frequently detected species (İlemin, 2010; Mengüllüoğlu, 2010; Akbaba and Ayaş, 2012; Table 2). Kazanki and Perzanowski (1997) stated that the detection rate of wild boar depends on the abundance of gray wolf and golden jackal. Lanszki et al. (2006) explained that golden jackals feed on piglets, and Mattioli et al. (1995) and Jedrzejewski et al. (2002) explained that wolves feed on both newly born and young pigs. Mengüllüoğlu (2010) suggested that the low density of wild boar was due to the rarity of food in the study area, which was low in humidity, and to hunting, which takes place at low elevations. According to our findings, the gray wolf is rare in Zonguldak. On the other hand, although there is a dense golden jackal population, milder winters, humid forests, and rich food resources support the high density of wild boars in the area. Zonguldak Province provides suitable weather conditions (average winter temperature is about 7 °C) for this species (https://www.mgm.gov.tr).

Among the detected carnivore species, golden jackal has the second highest detection rate. The detection rate of this species is 1.38 in Beypazarı forests (Mengüllüoğlu, 2010). Gupta et al. (2014) recorded that golden jackal is the wild mammal species least affected by human influence; it roams in open fields during the day.

Similarly, golden jackal was found to be common in Region A in Zonguldak. Lanszki et al. (2006) reported that golden jackal and red fox are sympatrically distributed. These two species were detected sympatrically in Zonguldak during our surveys.

The detection index of the red fox was lower in Zonguldak than the results from other studies in other parts of Turkey (Can, 2008; İlemin, 2010; Mengüllüoğlu, 2010). This may be because of the high frequency of golden jackal, which has similar ecological requirements.

Though they are small in size, the hedgehog and Caucasian squirrel were also recorded by camera traps. Since the camera trap setup was not designed for these smaller species, detectability was likely low, explaining low density values in contrast to other studies.

Brown bear was recorded as rare in Zonguldak, contrary to other studies performed in nearby localities (Can, 2008; Soyumert, 2010) (Table 2); this may be due to lower altitudes and greater human pressure in Zonguldak. In contrast, Burton et al. (2018) found very high densities of the species in neighboring Armenia using camera traps.

Camera trap records for brown hare, Eurasian otter, pine marten, gray wolf, and red deer were limited. Out of these species, Eurasian otter and weasel were not easily detected by all camera traps because they have a habitat-specific and/or area-specific distribution. Ten opportunistic camera traps were thus set up specifically for these species.

Martes spp., whose species identification is challenging, has the second highest detection rate (6.26 number of records/100 CTDs) among the detected species. Discerning between the two species was challenging. This study provided the best record of the pine marten, whose distribution in Turkey is not well known, since most of the records may belong to beech marten. Only 7% (0.93%) of all marten records (N = 754) were confidently identified

Table 2. Detection rate (number of records/total number of records × 100), total trap success frequency (number of records/total number of records), species richness (Shannon_H) of Yenice, Karabük (Can, 2008), Beypazarı, Ankara (Mengüllüoğlu, 2010), Datça and Burun (A = Firigana, 2 = Maki, 3 = Kızılçam) (İlemin, 2010), and Ankara (Akbaba and Ayaş, 2012).

Species	Zonguldak (This study)	Yenice (Can, 2008)	Beypazarı (Mengüllüoğlu, 2010)	Datça (İlemin, 2010)			Bozburun (İlemin, 2010)			Çamlıdere (Akbaba and Ayaş, 2012)	Bartın (Soyumert, 2010)
Sus scrofa	8.97	12.66	1.65	8.66			7.69			0.47	28.44
Martes spp.	6.26										2.78
Canis aureus	4.76		1.38								0.9
Erinaceus concolor	2.20		0.08				0.04				0.51
Capreolus capreolus	1.98	2.83									28.51
Felis silvestris	1.86	1.75					0.32				3.08
Meles meles	1.84		1.97	0.18			0.94			0.09	1.68
Vulpes vulpes	1.09	2.83	4.76	1.91			3.66			1.05	12.61
Sciurus anomalus	1.07		1.32				0.12				0.34
Ursus arctos	0.33	1.08	0.03	0.05						0.28	9.29
Lepus europeus	0.12		8.59	0.94			1.56			4.78	3.79
Lutra lutra	0.08										
Martes martes	0.06	0.66									
Canis lupus	0.05	0.75	1.49							1.24	3.08
Cervus elaphus	0.05		5.16							1.33	1.92
Martes foina	0.03		0.86	0.13			0.86				
Mustela nivalis	0.03						0.04				0.02
Total number of photo traps	50	16	30	36			36			21	
Total number of camera trapping days	11,868	1200	3699	6853			6853			1046	31,063
Number of species	16	12	13	13			13			8	12
Total number of records	3,653	271	1,020	1,043			1,043			114	4,640
Total trap success frequency	0.31	0.23	0.28	0.15			0.15			0.11	0.15
				A	B	C	A	B	C		
Species richness (Shannon_H)	2.04	1.27	1.97	0.41	0.34	0.31	0.58	0.33	0.36		

as pine marten, and only 4% of the other records were confidently identified as beech marten. Considering the species' similar morphology, camera trapping may not be appropriate to distinguish between these species. Soyumert (2010) also suggested that a precise identification of *Martes* spp. with photographs was not possible. Can (2008) recorded a 0.66% detection rate for pine marten in Yenice Forest. This rate is high compared to the outcome of our research. On the other hand, Can (2008) recorded only pine marten and did not mention beech marten. However, there is no doubt that some of his records should be attributed to beech marten. He mentioned that, since taxonomic literature generally mentioned martens in the area as pine marten, he accepted all marten records as pine marten without noting the details of the photos (personal communication). The fact that pine marten has a low detection rate and a disputed taxonomic status in Turkey makes it necessary to do more research on this species.

Gray wolf is commonly distributed in Turkey; however, population density is very low (Ertürk, 2010). This species provided only 0.21% of all of the records (n = 3653) from Zonguldak. *C. lupus* is regarded as dangerous in Turkey for domestic animals and is thus under much human pressure. That is why its population is under threat of decreasing (Can, 2001). Considering that the minimum elevation suitable for the distribution of wolves in Turkey is 800–900 m a.s.l. (Can, 2001), it can be concluded that a large area of Zonguldak is not suitable for wolf distribution, as our findings also show. On the other hand, Buzbaş (2002) detected wolves in areas between 40 m and

800 m a.s.l. in western Thrace. According to Massolo and Meriggi (1998), the main reason why wolves prefer areas with higher elevations is that such places are further from human pressure and are therefore safer.

Red deer, which is the largest wild herbivore mammal in Turkey, constituted only 0.021% (n = 6) of the total number of species records (n = 3653) detected in Zonguldak. Distribution of this species in Zonguldak is very scarce. Records of this species were obtained from the Zonguldak–Karabük border. This species, which used to be common, is represented in small populations and almost extinct due to overhunting in most areas in Turkey (Mengüllüoğlu and Bilgin, 2010). Can (2008) did not record any red deer from Karabük. On the other hand, Soyumert (2010) recorded the species from Bartın and Ankara. Mengüllüoğlu (2010) reported the species with the second highest detection rate from Karabük and researcher highlighted the fact that this rate depended on the quality of habitat and the high reproductive capacity of the species in this protected area.

Albayrak et al. (2012) suggested that 26 days would be sufficient to detect all carnivore species by camera trapping in habitats similar to that of Beydağları in Turkey. Zielinski et al. (1995) reported that a minimum of 28 days was required for the detection of rare carnivore species in camera-trapping studies. However, during this study in Zonguldak, only 6 (wildcat, red fox, Eurasian badger, golden jackal, beech marten, and brown bear) out of 10 carnivore species were recorded in the first 26 camera trapping days. This result shows that 26 days are not sufficient to detect all carnivore species in Black Sea Euxine–Colchic deciduous forests. The other carnivores that could not be determined in the first 26 days were gray wolf, Eurasian otter, weasel, and pine marten. Gray wolf is a rare species in the Zonguldak region and was only recorded in winter. Eurasian otters live around the rivers and seaside; to get their records, a specific photo trap setting is needed. Weasels are very small and very fast, making it less easy to record them with camera traps. After the first day, many marten records were taken; however, a definite pine marten was recorded on day 46. However, it is likely that some of the previous marten records could be pine marten. Hence, to say that 26 days is enough to record all carnivore species in an area by camera traps is logical if one excludes very small species, seasonal visitors, or species that require special effort, such as the Eurasian otter.

The distribution of species in Regions A and B in Zonguldak shows that brown bear, red deer, roe deer, red fox, and brown hare prefer natural, unchanged areas where human pressure is low; on the other hand, golden jackal, wild boar, porcupine, and Eurasian badger prefer agricultural areas and urban areas where they can find more food produced or discarded by humans. The most important factors that determine the species diversity seem to be human pressure and habitat alteration, which mostly affected Region A.

Considering the camera trapping days until the first detection of each species (calculation was made for the first 26 days and as of the time when these camera traps started to operate simultaneously), there were 9 species whose camera trap records were taken at the initial times of setting up the camera traps (Table 1). The weasel had a low detection rate due to its small body size and its fast movements; its time to first detection was very long. Tobler et al. (2008) suggested that camera trapping success is proportionate to body size; animals of smaller size can evade the camera trap trigger.

When compared to other studies from different parts of Turkey (Table 2), Zonguldak has a higher diversity of mammal species because of large natural habitats and old forests, as well as less human pressure across the province. Mammalian diversity is also richer in natural areas (Region B) than in modified and human-populated areas (Region A) in Zonguldak.

While this study provides a detailed inventory of medium-sized and large mammal species' distributional data for Zonguldak Province, it also highlights the need for further studies to help understand the factors driving these species' distributions.

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Appendix 1. Location information (related districts, UTM coordinates, and elevations) of camera trapping stations.

Map no.	District	Station name	Coordinates (UTM)	Elevation (m a.s.l.)
1	Alaplı	Belen1	N 41.07072, E 031.39638	301
2	Alaplı	Belen2	N 41.07133, E 031.37867	152
3	Alaplı	Belen3	N 41.04878, E 031.40351	273
4	Alaplı	Belen4	N 41.04887, E 031.38321	255
5	Alaplı	Alaplı1	N 41.129367, E 31.495750	78
6	Alaplı	Alaplı2	N 41.117517, E 31.532133	124
7	Alaplı	Gümeli4	N 41.08157, E 031.54575	691
8	Alaplı	Gümeli1	N 41.08532, E 031.57065	370
9	Alaplı	Gümeli3	N 41.06626, E 031.54286	816
10	Alaplı	Gümeli2	N 41.06674, E 031.57190	509
11	Alaplı	YukarıGümeli1	N 41.082648, E 31.683405	944
12	Alaplı	GümeliYukarı2	N 41.077116, E 31.662642	651
13	Devrek	Yeşilöz4	N 41.039200, E 031.758683	770
14	Devrek	Yeşilöz3	N 41.040150, E 031.768350	763
15	Devrek	Yeşilöz1	N 41.042733, E 031.722967	1,416
16	Devrek	Yeşilöz2	N 41048350, E 031.746483	1,245
17	Devrek	Yeşilöz5	N 41.062417, E 031.820783	368
18	Devrek	Yeşilöz6	N 41.089533, E 031.837917	303
19	Devrek	Akçabey	N 41.044850, E 31.888833	218
20	Devrek	Yağmurca	N 41.112985, E 31.875715	163
21	Alaplı	Sütlüce3	N 41.19118, E 031.76890	646
22	Devrek	Sütlüce4	N 41.18240, E 031.79306	1,008
23	Alaplı	Sütlüce1	N 41.17707, E 031.75227	735
24	Devrek	Sütlüce2	N 41.16542, E 031.76678	851
25	Devrek	Özpınar	N 41.171166, E 31.908372	117
26	Devrek	DevrekOdunD	N 41.127936, E 31.99897	431
27	Devrek	Beldibi4	N 41.11189, E 031.98604	584
28	Devrek	Beldibi3	N 41.09631, E 031.97211	673
29	Devrek	Beldibi2	N 41.08274, E 031.98170	522
30	Devrek	Beldibi1	N 41.10614, E 032.00134	433
31	Devrek	Dorukan1	N 41.10456, E 32.035439	752
32	Devrek	Dorukan2	N 41.096756, E 32.055028	671
33	Devrek	Dorukan3	N 41.116562, 32.053142	898
34	Devrek	Yasıören	N 41.298960, E 31.947216	520
35	Gökçebey	Örmeciköyü	N 41.329515, E 32.082581	52
36	Gökçebey	Gökçebey1	N 41.30510, E 32.18326	105
37	Çaycuma	Nebioğlu1	N 41.42617, E 32.25794	189
38	Çaycuma	Çorak	N 41.503865, E 32.118274	53
39	Zonguldak	Derecikören	N 41.546950, E 32.077350	15
40	Çaycuma	Sazköy2	N 41.56849, E 32.09651	191
41	Çaycuma	Sazköy1	N 41.56823, E 32.08560	148
42	Zonguldak	Türkali	N 41.526017, E 32.007817	93

Appendix 1. (Continued).

43	Zonguldak	Göbü2	N 41.522867, E 31.970417	33
44	Zonguldak	Göbü1	N 41.516750, E 31.973067	51
45	Zonguldak	Kurtköy2	N 41.49432, E 031.95759	353
46	Zonguldak	Kurtköy1	N 41.48234, E 031.97594	288
47	Zonguldak	Kurtköy4	N 41.47143, E 031.95460	496
48	Zonguldak	Kurtköy3	N 41.48947, E 031.94437	280
49	Kozlu	Değirmenağzı	N 41.245569, E 031.431938	66
50	Kozlu	Ulutan	N 41.41335, E 031.79116	191
51	Kozlu	Dağlıca4	N 41.37995, E 031.77895	594
52	Kozlu	Dağlıca1	N 41.36486, E 031.78524	644
53	Kozlu	Dağlıca2	N 41.35836, E 031.76407	467
54	Kozlu	Dağlıca3	N 41.37294, E 031.75831	547
55	Kozlu	Ilıksu	N 41.39528, E 031.66542	238
56	Ereğli	Tepeoren	N 41.38236, E 031.64357	169
57	Ereğli	Güllük	N 41.278237, E 31.720322	370
58	Ereğli	Süleymanbeyler	N 41.284139, E 31.576460	178
59	Ereğli	Keşkek	N 41.31182, E 031.49075	430
60	Ereğli	Balı	N 41.30837, E 031.46579	364
61	Ereğli	Ereğli1	N 41.185905, E 031.23401	71
62	Ereğli	Işıklı	N 41.201519, E 31.510077	124

Appendix 2. Detected species, number of camera trap stations (map no.), and total number of records.

Map no.	Camera trap stations	*Sus scrofa*	*Martes* spp.	*Canis aureus*	*Erinaceus concolor*	*Capreolus capreolus*	*Felis silvestris*	*Meles meles*	*Vulpes vulpes*	*Sciurus anomalus*	*Ursus arctos*	*Lepus europaeus*	*Lutra lutra*	*Martes martes*	*Canis lupus*	*Cervus elaphus*	*Martes foina*	*Mustela nivalis*	TOTAL
55	Iliksu	162	22	206			7	37	2	6				1				2	445
51	Daglica4	82	26	13	58		27	71	1										278
10	Gümeli2	74	68	6	1	30	21	1	1		1			2			1		206
41	Sazkoy1	77	37	24	1	3	18	1	3	27									191
30	Beldibi1	22	16	37	31	13	19	4	4	40	2			1					189
52	Daglica1	108	7	9	45				1						2				172
36	Gökçebey	16	42	36			10	23	16		3								146
53	Daglica2	88	22	14	7	1	6		1		1				1				141
2	Belen2	19	63	15	2	3	10	5	17		5								139
29	Beldibi2	15	42	18	15	13	6	3	1		2			1	1	1			118
1	Belen1	41	60	1	2		3	1	4	3	2								117
23	Sutluce1	43	5	1	2	30	9			18	7								115
7	Gümeli4	4	11	7	34	34	7		9	3	1								110
40	Sazkoy2	72	5	17	4	1	6		1										106
3	Belen3	2	24	3	2		15	44	10		5								105
54	Daglica3	37	46	4	4		4	1											96
37	Nebioglu	36	25	14			10	4	3										92
28	Beldibi3	16	16	4	1	25	1	1		1	1	3							69
27	Beldibi4	6	30			9			5	13									63
33	Dorukan3	23		20		4	1		7		2				1	1			59
45	Kurtkoy2	5	17	10	4		8	2		9									55
13	Yesiloz4	4	1	21			1	1	21		2	4							55
21	Sutluce3	8	26	4		2	7	1	3		1								52
8	Gümeli1	6	32	3		2								2			2		47
56	Tepeoren	9	8	7	14		4	2	1										45
32	Dorukan2	9	8	6		12	1	4		1						1			42
46	Kurtkoy1	5	11	5	13		1												35
17	Yesiloz5	17		10		1		1											29
4	Belen4	1	16				4	4	2	1									28
22	Sutluce4	1	6		1	20													28
60	Balı	8	1		6		5	6											26
31	Dorukan1	9		2	1	11										3			26
24	Sutluce2		7			12	2												21
26	DevrekOdunD	1	8	3		2	1		1	4									20
48	Kurtkoy3	3	3	2	8		3												19
47	Kurtkoy4		8	9			2												19
49	Degirmenagzi	10		7					1										18

Appendix 2. (Continued).

9	Gümeli3	2	6			4	1	1			2								16
16	Yesiloz2	5	1		2	2			3						1				14
59	Keskek1	3	3	5															11
6	Alaplı2		3	5			1			1									10
5	Alaplı1																		0
50	Ulutanbaraji	4	1	2					3										10
15	Yesiloz1			2					4			3							9
36	GümeliYukari2	2	4			1			1										8
35	Ormecikoyu	1	4										3						8
14	Yesiloz3	1		2					1			4							8
61	Eregli1	1		4					1										6
44	Göbü1	3		3															6
25	Ozpinar												5						5
38	Çorak		1	1	1														3
43	Göbü2		2															1	3
57	Güllük				1				1										2
11	GümeliYukari1										2								2
62	Isikli	1		1															2
58	Süleymanbeyler			1	1														2
34	Yassioren	1		1															2
19	Akçabey															1			1
39	Derecikören												1						1
42	Türkali	1																	1
20	Yagmurca												1						1
	TOTAL	1064	744	565	261	235	221	218	129	127	39	14	10	7	6	6	4	3	3653