Status and activity patterns of the Caracal, *Caracal caracal* (Schreber, 1776), in Datça and Bozburun Peninsulas, Southwestern Turkey

(Mammalia: Felidae)

Yasin İlemin, Behzat Gürkan

Abstract. We were able to document the presence of the Caracal, *Caracal caracal* (Schreber, 1776), in southwestern Turkey in the course of a survey carried out in Datça and Bozburun Peninsulas between December 2007 and August 2008 with the help of camera traps. The Caracal was found to occur mainly (72% of the records) in pine woodlands with high habitat heterogeneity. 28% of the records are from maquis vegetation and this may be related to the high abundance of wild goats in this habitat, especially at the end of the winter season. However, no Caracal records were obtained from low scrub (phrygana) vegetation. Caracals were active during both day and night except for late morning and around midnight. Altogether, 13 medium-sized and large mammal species were detected during the camera trap survey.

Key words. Camera trap, Datça Peninsula, activity pattern, *Felis silvestris*, Middle East.

Introduction

The Caracal (*Caracal caracal* (Schreber, 1776)) is regarded as a species of Least Concern (IUCN 2010) on a global level. However, in Turkey it is very rare and only a few records are available (Kümerloewe 1986, Krystufek & Vohralik 2001, Özkurt et al. 2003, Giannatos et al. 2006). Studies on its conservation ecology are very limited (Hepcan et al. 2008). The Caracal is an important large carnivore species in the Turkish Mediterranean, and large carnivores are sensitive indicators of ecosystem integrity since they survive only where lower trophic levels remain relatively undisturbed (Gros et al. 1996).

The Caracal was photographed by camera traps in Turkey for the first time in 2005 by Giannatos et al. (2006). That case showed the importance of camera trap surveys in projects that focus on wildlife ecology and conservation in Turkey. We present here the results of the first wide-ranging systematic survey focused on the activity patterns of the Caracal in the Datça-Bozburun Special Environmental Protection Area. This survey is also one of the first intensive studies conducted by using camera traps in Turkey.

The study area

The study was carried out in the Datça and Bozburun Peninsulas, located in south-western Turkey. The area has the status of a “special environmental protection area”, in terms of both archaeological and natural aspects (Fig. 2). Although tourism activities have increased in recent decades, especially in the south part of the Datça Peninsula, human activities have remained at a
relatively low level in rural areas in the north part of the Datça Peninsula (Kafali 1998). The area has a Mediterranean climate with hot and dry summers and mild and rainy winters. Three main types of vegetation dominate the study area. The first is Calabrian Pine woodlands (Pinus brutia) at different post-fire succession regeneration stages. These woodlands are interspersed with areas of tall shrub vegetation with evergreen plant species (maquis), predominantly covered by Arbatus andrachne and A. unedo. Other typical species include Quercus spp., Erica spp., and Phillyrea latifolia. Third, there are areas with low shrub vegetation (phrygana). Typical species include Thymus spp., Cistus spp., Genista acanthoclada, and Lavandula stoechas (Kaynaş & Gürkan 2008).

**Methods**

We conducted the survey between December 2007 and August 2008, by using 36 CamTrakker (Cam-Trakker, Georgia, USA) passive infrared camera traps. Starting two months before mounting the camera traps, a preliminary examination was made of the study area for suitable locations for the traps. The camera traps were then distributed over the study area to represent different vegetation types (Fig. 2). As each camera trap station represented a 2.6 km² grid cell, the survey covered an area of approximately 100 km² in total. The camera traps were placed approximately 1.5 km away from each other, as in other studies (e.g. Wallace et al. 2003, Sanderson 2004, Perrine 2005). The survey extended over 6863 camera trap days. To compute a relative abundance index for each species, detections were added up for all the camera traps over the entire
survey period, multiplied by 100 and divided by the total number of camera trap days (see also SARMETO et al. 2004, GIANNATOS 2006).

To compute the activity pattern of the Caracal, we filtered the camera trap data based on the assumption that multiple photographs of a species taken at a single camera trap station during any 24-hour period (beginning at midnight) represented only one individual. That is, if a Caracal was photographed at a single site three times during a 24-hour period, then the three photographs were counted as a single photograph of the same Caracal (SANDERSON 2004).

It was not possible to identify each Caracal photograph at an individual level due to the lack of pelage patterns on Caracal fur.

**Results**

During our 6863 camera trap days, we recorded a total of 1039 photographs of target species, namely 13 medium-sized and large mammal species: Caracal (*Caracal caracal*), Wild Cat (*Felis silvestris* Schreber, 1775), Eurasian Badger (*Meles meles* Linnaeus, 1758), Beech Marten (*Martes foina* (Erxleben, 1777)), Red Fox (*Vulpes vulpes* Linnaeus, 1758), Brown Bear (*Ursus arctos* Linnaeus, 1758), Wild Boar (*Sus scrofa* Linnaeus, 1758), Wild Goat (*Capra aegagrus* Erxleben, 1777), Squirrel (*Sciurus anomalus* Gmelin, 1778), Hedgehog (*Erinaceus concolor* Martin, 1838), Brown Hare (*Lepus europaeus* Pallas, 1778), Porcupine (*Hystrix indica* Kerr, 1792), and Weasel (*Mustela nivalis* Linnaeus, 1766).
Altogether, 44 Caracal pictures were obtained from eleven different stations in the Datça Peninsula. No Caracal records were obtained from Bozburun Peninsula. Seven of the stations where Caracals were found were located in pine woodlands (32 unfiltered and 23 filtered photographs, respectively) and four stations in maquis vegetation (12 unfiltered and 9 filtered photographs). No Caracal photographs were obtained in the phrygana vegetation. All maquis vegetation captures occurred during the spring months, including one pregnant Caracal on 19 February (early spring) in dense maquis vegetation.

Forty-four Caracal photographs that were obtained in the study were filtered to 32 photographs for the activity pattern estimations (Figs 1, 4-5). The activity pattern showed a bimodal distribution (Fig. 3). However, filtered and unfiltered records were tested against the null-hypotheses of equal distribution and no difference was found between time categories. Caracals were found to be active during both day and night ($\chi^2 = 11.5$, unfiltered $\chi^2 = 12.7$, both p>0.05; Chi-square test) except for late morning and around midnight, but tend to especially active in the early morning and late afternoon period (Fig. 3).

At one station, Caracal caracal and Capra aegagrus were found in two subsequent photographs taken within two hours.

**Discussion**

In this study, we have demonstrated the importance of camera traps in wildlife surveys, especially for estimations of the activity patterns of the rare and cryptic mammal Caracal caracal in Turkey. The Anatolian Leopard (Panthera pardus tulliana Valenciennes, 1856) was not recorded by the camera trap survey although it had been observed by local people and hunters up to 15 years ago in the northern part of the Datça Peninsula (local questionnaire survey in the region, n=4).
Table 1. Camera-trapping data for the Datça-Bozburun Special Environmental Protection Area. N_{ps} = Number of positive camera stations, N_{d100}/Total number of camera trap days = Number of detections per 100 camera-days, RAI = Relative Abundance Index.

<table>
<thead>
<tr>
<th></th>
<th>Datça</th>
<th>Bozburun</th>
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<tr>
<td></td>
<td>N_{ps}</td>
<td>N_{d100}/Total no.</td>
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<tr>
<td>Caracal caracal</td>
<td>11</td>
<td>0.99</td>
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<tr>
<td>Sus scrofa</td>
<td>20</td>
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<tr>
<td>Vulpes vulpes</td>
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<td>1.91</td>
</tr>
<tr>
<td>Lepus europaeus</td>
<td>7</td>
<td>0.94</td>
</tr>
<tr>
<td>Meles meles</td>
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<td>0.18</td>
</tr>
<tr>
<td>Capra aegagrus</td>
<td>5</td>
<td>1.75</td>
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<tr>
<td>Martes foina</td>
<td>3</td>
<td>0.13</td>
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<tr>
<td>Ursus arctos</td>
<td>2</td>
<td>0.05</td>
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<tr>
<td>Hystrix indica</td>
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<td>1.64</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>Erinaceus concolor</td>
<td>1</td>
<td>0.04</td>
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<tr>
<td>Sciurus anomalus</td>
<td>1</td>
<td>0.12</td>
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Our data indicate that the Caracal is more abundant in the Datça Peninsula when compared with a previous study conducted in Termessos National Park (GIANNATOS et al. 2006); RAI in Datça Peninsula was 10.9 compared to 0.58 in Termessos National Park. This abundance may be related to the suitable conditions in the peninsula for the Caracal, including suitable habitat structure, lack of domestic goat grazing activities, and abundant prey such as rodents, lagomorphs and birds (ILEMIN 2010). Also in the northern part of the peninsula young wild goats (Capra aegagrus) are a common prey of the Caracal, especially in the spring months (ILEMIN 2010). On the other hand, the lower Caracal density in Termessos National Park may be attributed to the low densities of prey in the area, namely rodents, lagomorphs, Wild Goats and ground birds (GIANNATOS et al. 2006).

The bimodal distribution of the activity pattern is typical for most cat species (TIGAS et al. 2002). Our camera trapping data indicated that Caracals are active during both day and night, except late morning and around midnight, and they were relatively more active in the early morning and late afternoon periods, which is similar to the results of another study conducted in Iran (FARHADINIA et al. 2007). This wide temporal activity may also show that the Caracal is a generalist and an opportunistic feeder (AVENANT & NEL 2002), possibly since this cat can feed on both diurnal and nocturnal prey. We found that Caracal occurrence in pine woodlands (72% of records) is greater than in maquis vegetation. Pine woodlands include different post-fire succession regeneration stages, from recently burned sites to unburned mature stands. Several shrub and sub-shrub species are also found in these pine woodlands (TAVŞANOĞLU & GÜRKAN 2009). The pine woodlands of the region have a high habitat heterogeneity and high landscape diversity, which is a typical consequence of Mediterranean wildfires (TAVŞANOĞLU 2008). KAYNAŞ (2008) has shown that different post-fire stages of pine woodlands in the region are used by several small mammals and also by habitat generalist, medium-sized and large mammal species such as Vulpes vulpes, Meles meles, and Martes foina (SOYUMERT et al. 2010). The higher Caracal presence in the pine
woodlands of the peninsula may therefore be the result of the abundant prey species that are found in these heterogeneous environments. This is the result of the high productivity of pine woodlands, with abundant prey items such as rodents and birds. Caracal activities in pine woodlands may also be related to Caracal hunting strategies. Our data also indicate that there are no competitors which could have a negative influence on Caracal abundance in the Datça Peninsula (Table 1), except for *Vulpes vulpes*. Caracal presence in the maquis habitat may be related to the high abundance of wild goats in this habitat, especially at the end of the winter season. We observed that wild goats especially preferred the northern part of the Datça Peninsula during the spring and summer months, because the valleys in this part of the peninsula have a dense maquis vegetation that provides good shelter from solar radiation and for their reproduction in spring (İLEMIN 2010), which agrees with other studies conducted on wild goats in the Mediterranean region of Turkey (GÜNDOĞDU 2006, MACAR & GÜRKAN 2009). It is therefore possible that individual Caracals follow their main prey (i.e. wild goats) towards the dense maquis vegetation during these periods.

During the survey, one pregnant Caracal was recorded in early spring. Since it is known that Caracals give birth usually to 2 to 3 cubs in spring (ETEMAD 1985), we consider this to be important evidence for the existence of a reproductive population of Caracal in the Datça Peninsula. We believe that the results of this study give an important insight into the conservation of Caracals in the region. In this context, pine woodlands and the maquis vegetation of the Datça Peninsula will have a special priority in the next conservation plans.
Fig. 5. Camera trap photograph of a Caracal in pine woodlands on Dağça Peninsula.

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